

SNCURCS 2026

The 22nd State of North Carolina Undergraduate Research and Creativity Symposium

November 7, 2026

State of North Carolina Undergraduate Research & Creativity Symposium

Colleges, universities, and community colleges in North Carolina come together each year to host a symposium that showcases North Carolina's undergraduate students' research and creative work. SNCURCS (pronounced as 'snickers') provides undergraduate scholars a space to share their results with academics across numerous fields.

The first State of North Carolina Undergraduate Research and Creativity Symposium was held on November 9th, 2005, in Raleigh with 218 oral, poster and performance presentations and over 450 attendees, including high school students and teachers.

The 2026 SNCURCS is co-hosted by the University of North Carolina at Charlotte and Central Piedmont Community College. This year there are over 620 presentations by 771 student authors. The presentations came from 49 institutions across North Carolina and represented more than 34 academic disciplines. We welcome almost 1500 attendees to the campus of the University of North Carolina at Charlotte on Saturday, November 7, 2026.

2026 Planning Committee

Hosts:	Lance Barton	Amber Griffin
Office of Undergraduate Research:	Sarah Powell	Sarah Hedrick

Committee Members:

Sabrina Brown	Erik Byker	Ryan Chester	Nick Davros
Kailey Hess	Ellie Ivey	Denise Lynch	Patrick Madsen
Tabitha McDaniel	Brigid Mullany	Stephanie Norander	Samantha Pfeiffer
Lisa Walker			

Student Assistants:	Caelan Murphy	Kate Dydynski	Lillian Mirosavich
	Gabby Sullivan	Atenas Hidalgo	

STATE OF NORTH CAROLINA
OFFICE OF THE GOVERNOR

JOSH STEIN
GOVERNOR

November 7, 2026

Dr. Lance Barton
Director, Office of Undergraduate Research
University of North Carolina at Charlotte
9201 University City Boulevard
Barnard 109
Charlotte, NC 28223-0002

Dear Friends,

I am pleased to welcome you to the 22nd State of North Carolina Undergraduate Research and Creativity Symposium!

North Carolina's future depends on the talent, curiosity, and determination of its people. The students participating in this symposium exemplify those qualities through their commitment to discovery, innovation, and creative problem-solving. Their work reflects not only academic excellence but also a desire to strengthen our communities and address the challenges and opportunities that lie ahead.

I extend my sincere appreciation to the faculty, staff, and students whose dedication and collaboration have made this event possible. I also thank the host institutions – the University of North Carolina at Charlotte and Central Piedmont Community College – and partner organizations for their commitment to providing meaningful research and creative opportunities for students across our state. I would also like to recognize the faculty mentors, researchers, and campus leaders who guide and support these efforts. Their investment in student success helps cultivate the next generation of scholars, innovators, entrepreneurs, educators, and public servants.

As you share your research and creative achievements, I encourage you to continue asking bold questions, pursuing new ideas, and seeking ways to make a positive impact. The knowledge and experience gained through these endeavors will serve you well throughout your careers and in your service to our state.

Sincerely,



Josh Stein
Governor

Dear Participants of the State of North Carolina Undergraduate Research & Creativity Symposium,

Congratulations on your participation in this year's symposium and on taking this important step in sharing your research and creative scholarship with the broader academic community. Presenting your work is a significant accomplishment and a reflection of your curiosity, dedication, and willingness to explore questions that matter.

At the Council on Undergraduate Research (CUR), we believe undergraduate research and creativity are transformative experiences that help develop the next generation of innovators, problem-solvers, and leaders. Through your work, you are not only expanding knowledge in your field, but also developing the skills to ask meaningful questions, communicate ideas, and engage with perspectives different from your own. These skills will serve you throughout your academic journey, your career, and your life.

Sharing your research is also a powerful form of advocacy. By bringing your discoveries, insights, and creative contributions to new audiences, you demonstrate the value of inquiry and the important role that knowledge plays in addressing the challenges and opportunities of our world. I am excited to personally share in this experience with you today. Seeing the confidence and enthusiasm on the faces of student researchers as they present their projects is a powerful motivator in the ongoing work of CUR. We strive to sustain and build structures and opportunities that provide all undergraduates the ability to experience this transformative power of research, and seeing your advocacy and knowledge firsthand at this symposium further solidifies this aim.

As you reflect on your experience today, I encourage you to take the next step in your undergraduate research journey by applying to present at the National Conference on Undergraduate Research (NCUR). The NCUR 2027 submission deadline is December 4, and we would be honored to see your work represented among thousands of undergraduate researchers from across the country. Presenting at NCUR provides an opportunity to share your scholarship on a national stage, connect with peers and mentors, and continue building the confidence and communication skills that will support your future success.

I commend each of you for your commitment to research and creativity, and CUR extends our appreciation to the faculty mentors, institutions, and organizers at the University of North Carolina at Charlotte and Central Piedmont Community College for creating opportunities for students to share their work. I look forward to seeing how your curiosity, creativity, and contributions continue to shape the world around you.

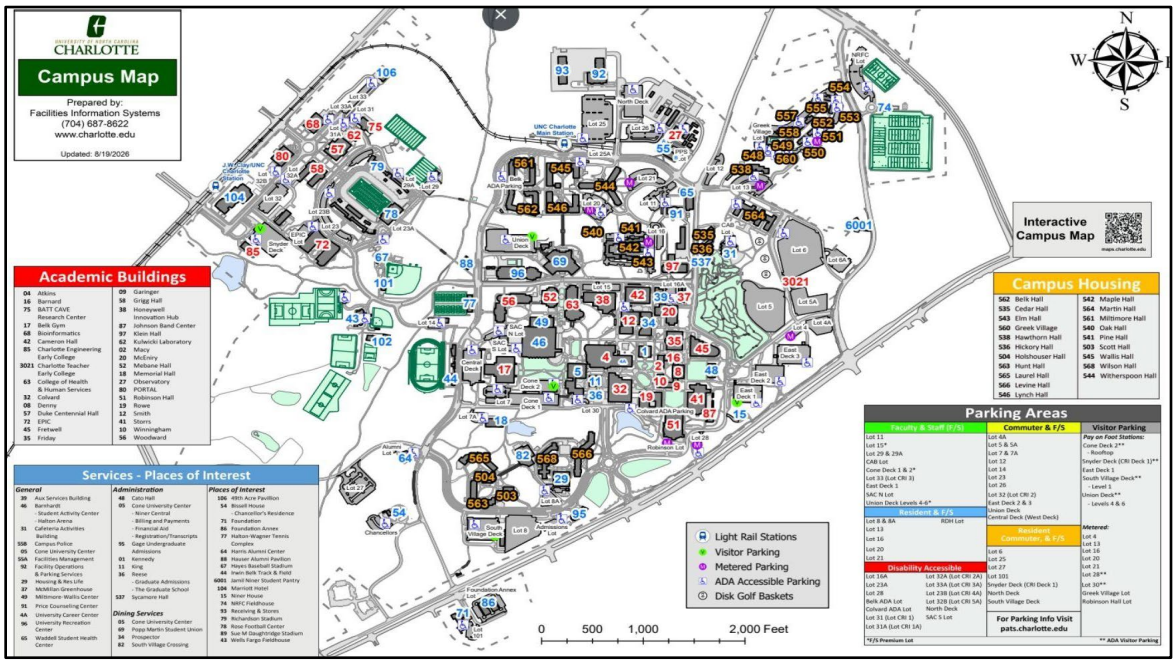
With admiration and encouragement,



Council on Undergraduate Research President 2026-2027

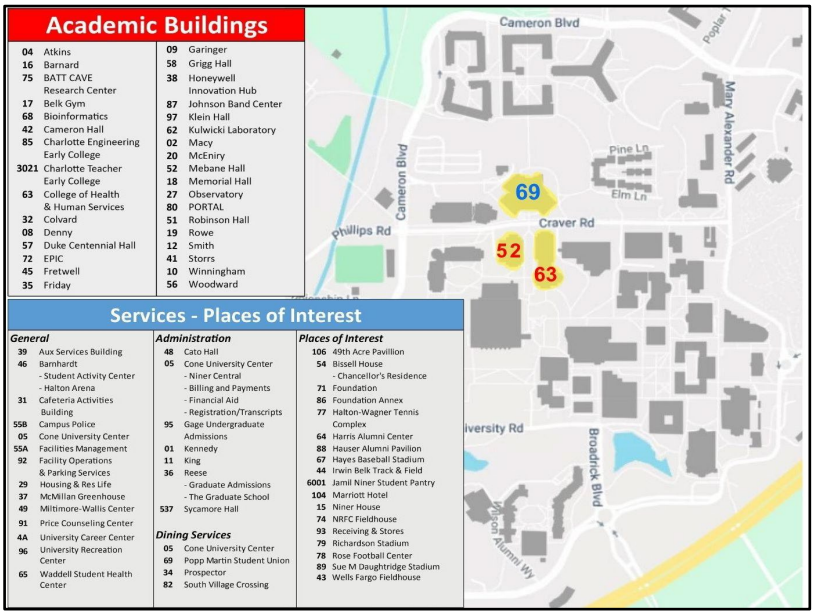
Getting Around Campus

We are excited to welcome everyone to UNC Charlotte for SNCURCS 2026! The following pages provide resources for parking locations, getting around campus, and a general overview of the agenda. An interactive map for the UNC Charlotte campus has been provided,



while static maps with further information can be found below, as well as through this link.

While the Popp Martin Student Union will be the primary location for registration, poster presentation, and various dining options, two additional buildings, Mebane Hall and the College of Health and Human Services will be used for oral presentations. These three buildings are highlighted on the static graphic below.



Parking

Car / Individual Parking

Individuals, or groups planning on commuting via cars, should park in the Union Parking Deck. The address for this parking deck is listed below. Parking signage will be posted throughout campus, directing cars towards Union Deck (signage will have a white background). Follow these signs to arrive at Union Deck. Both the visitor and student parking levels will be available for use so please utilize both entrances as needed.

Accessibility parking is available within Union Deck as well, with working elevators connecting guests to the Union via a skybridge.

To access the Popp Martin Student Union from Union Deck, either utilize staircases located at each corner of the parking deck, or the elevator, to floor 4 or floor 6. Floor 4 will take guests to the ground level, where a ramp can be accessed to arrive at the front doors of the Student Union. Floor 6 also accesses the Student Union through a sky bridge connected to the Union ground floor.

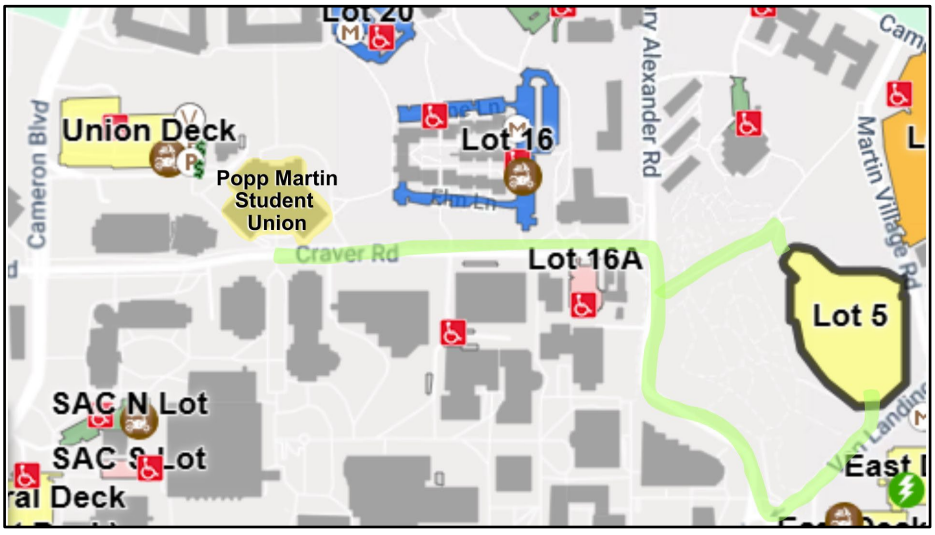
Union Deck Address: *Union Deck, 8775 Student Union Ln, Charlotte, NC 28223*

Bus Parking

Anyone planning on dropping off students before parking, most notably those in larger vehicles, should use the address to the Popp Martin Student Union below. Students may be dropped off on either side of Craver Rd, right in front of the Student Union. Signage will be placed around campus to direct buses and large vans to both the Student Union (white backgrounds), and then to specific bus parking (signage with dark green backgrounds).

Buses and large vans should plan to park in Lot 5, highlighted in the graphic below, after dropping students off at the Student Union. After parking, pedestrian routes may be found using the interactive maps here through the 'directions' tab. UNC Charlotte bus routes are available to all guests as well, with more details found here.

Popp Martin Student Union Drop-Off Address: *Popp Martin Student Union, 8845 Craver Rd, Charlotte, NC 28223*



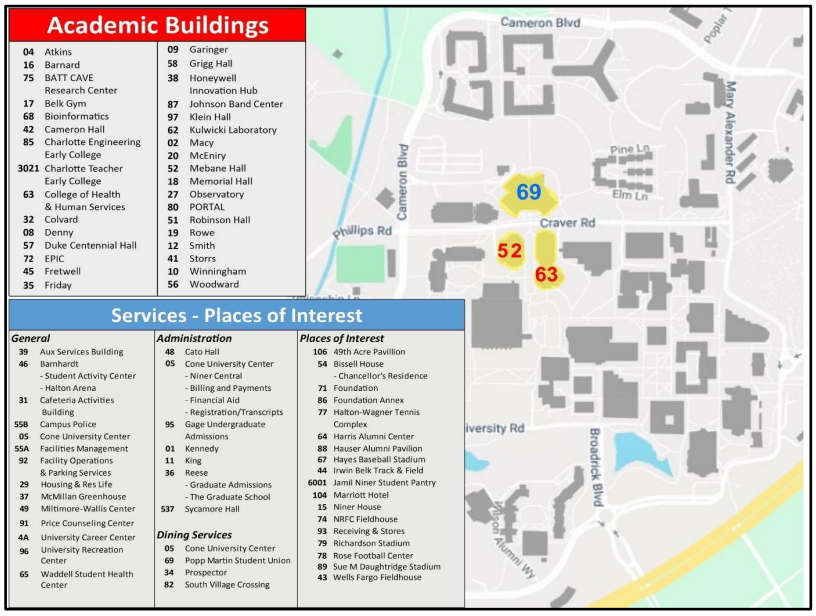
Registration

Registration will be hosted on the Ground Floor of the Popp Martin Student Union. Presenters and guests should register before attending any presentations to receive all materials, information, and merch.

Presentation Halls

Poster presentations will be hosted in Popp Martin Student Union in Room 340. Elevators will be available on all levels, as well as the main staircase located in the lobby. Signage will be posted throughout the lobby, directing attendees to both registration tables and presentation halls.

Oral presentations will be hosted in both Mebane Hall and the College of Health and Human Services, which are both located across the street from the Student Union, labeled as #52 and #63 in the map below. Specific room usage will be indicated below within the given agenda, with all rooms remaining accessible through various staircases or elevators throughout the buildings.



Grad Fair & Professional Development Sessions

The graduate fair will be hosted in the Popp Martin Student Union on Floor 2 & 3. More than thirteen distinct universities and graduate programs will be represented, with tabling remaining up from 10:15 am until 3:30 pm.

Professional Development sessions will be held in PMSU Room 263 throughout all four sessions, exploring different topics such as searching for the right graduate school, translating your skills to a resume format, and addressing the personal and psychological side of graduate education. *Preregistration is required for anybody wishing to participate.* Further information about the specifics and details of each PD can be found here under the 'Future Fair & Professional Development Workshops' tab.

UNIVERSITY OF NORTH CAROLINA
CHARLOTTE

Campus Map

Prepared by:
Facilities Information Systems
(704) 687-8622
www.charlotte.edu

Updated: 8/19/2026

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W E
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Interactive Campus Map

maps.charlotte.edu

Academic Buildings

04	Atkins	09	Garinger
16	Barnard	58	Grigg Hall
75	BATT CAVE Research Center	38	Honeywell Innovation Hub
17	Belk Gym	87	Johnson Band Center
68	Bioinformatics	97	Klein Hall
42	Cameron Hall	62	Kulwicki Laboratory
85	Charlotte Engineering Early College	02	Macy
3021	Charlotte Teacher Early College	20	McEniry
63	College of Health & Human Services	52	Mebane Hall
32	Colvard	18	Memorial Hall
08	Denny	27	Observatory
57	Duke Centennial Hall	80	PORTAL
72	EPIC	51	Robinson Hall
45	Fretwell	19	Rowe
35	Friday	12	Smith
		41	Storrs
		10	Winningham
		56	Woodward

Services - Places of Interest

General

39	Aux Services Building
46	Barnhardt - Student Activity Center - Halton Arena
31	Cafeteria Activities Building
55B	Campus Police
05	Cone University Center
55A	Facilities Management
92	Facility Operations & Parking Services
29	Housing & Res Life
37	McMillan Greenhouse
49	Miltimore-Wallis Center
91	Price Counseling Center
4A	University Career Center
96	University Recreation Center
65	Waddell Student Health Center

Administration

48	Cato Hall
05	Cone University Center - Niner Central - Billing and Payments - Financial Aid - Registration/Transcripts
95	Gage Undergraduate Admissions
01	Kennedy
11	King
36	Reese - Graduate Admissions - The Graduate School
537	Sycamore Hall

Dining Services

05	Cone University Center
69	Popp Martin Student Union
34	Prospector
82	South Village Crossing

Places of Interest

106	49th Acre Pavillion
54	Bissell House - Chancellor's Residence
71	Foundation
86	Foundation Annex
77	Halton-Wagner Tennis Complex
64	Harris Alumni Center
88	Hauser Alumni Pavilion
67	Hayes Baseball Stadium
44	Irwin Belk Track & Field
6001	Jamil Niner Student Pantry
104	Marriott Hotel
15	Niner House
74	NRFC Fieldhouse
93	Receiving & Stores
79	Richardson Stadium
78	Rose Football Center
89	Sue M Daughtridge Stadium
43	Wells Fargo Fieldhouse

Campus Housing

562	Belk Hall	542	Maple Hall
535	Cedar Hall	564	Martin Hall
543	Elm Hall	561	Miltimore Hall
560	Greek Village	540	Oak Hall
538	Hawthorn Hall	541	Pine Hall
536	Hickory Hall	503	Scott Hall
504	Holshouser Hall	545	Wallis Hall
563	Hunt Hall	568	Wilson Hall
565	Laurel Hall	544	Witherspoon Hall
566	Levine Hall		
546	Lynch Hall		

Parking Areas

Faculty & Staff (F/S)

Lot 11
Lot 15*
Lot 29 & 29A
CAB Lot
Cone Deck 1 & 2*
Lot 33 (Lot CRI 3)
East Deck 1
SAC N Lot
Union Deck Levels 4-6*

Resident & F/S

Lot 8 & 8A
Lot 13
Lot 16
Lot 20
Lot 21
RDH Lot

Disability Accessible

Lot 16A
Lot 23A
Lot 28
Belk ADA Lot
Colvard ADA Lot
Lot 31 (Lot CRI 1)
Lot 31A (Lot CRI 1A)
Lot 32A (Lot CRI 2A)
Lot 33A (Lot CRI 3A)
Lot 23B (Lot CRI 4A)
Lot 32B (Lot CRI 5A)
North Deck
SAC S Lot

Commuter & F/S

Lot 4A
Lot 5 & 5A
Lot 7 & 7A
Lot 12
Lot 14
Lot 23
Lot 26
Lot 32 (Lot CRI 2)
East Deck 2 & 3
Union Deck
Central Deck (West Deck)

Resident Commuter, & F/S

Lot 6
Lot 25
Lot 27
Lot 101
Snyder Deck (CRI Deck 1)
North Deck
South Village Deck

For Parking Info Visit pats.charlotte.edu

Visitor Parking

Pay on Foot Stations:
Cone Deck 2**
- Rooftop
Snyder Deck (CRI Deck 1)**
East Deck 1
South Village Deck**
- Level 1
Union Deck**
- Levels 4 & 6

Metered:
Lot 4
Lot 13
Lot 16
Lot 20
Lot 21
Lot 28**
Lot 30**
Greek Village Lot
Robinson Hall Lot

*F/S Premium Lot
** ADA Visitor Parking

Light Rail Stations
Visitor Parking
Metered Parking
ADA Accessible Parking
Disk Golf Baskets

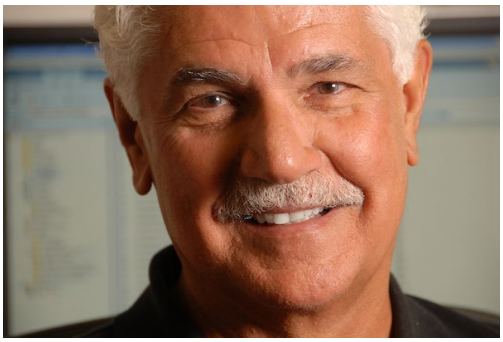
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UNIVERSITY OF NORTH CAROLINA CHARLOTTE | DIVISION OF RESEARCH	Altec
North Carolina Biotechnology Center®	N★C THE UNIVERSITY OF NORTH CAROLINA SYSTEM
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UNIVERSITY OF NORTH CAROLINA CHARLOTTE | THE GRADUATE SCHOOL	CAREER CENTER

SNCURCS 2026 is a Zero Waste Event!





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

The 2026 Barthalamus award winners are:

Student Name	**Mentor Name**	**Institution**
Nithilan Velavan	Stephen Schworer	UNC Chapel Hill
Austin Osborne	Jason Keeler	Highpoint University

Congratulations to these students! We look forward to hearing more about these projects and their outcomes.

Undergraduate Research Program

Grand Award Recipients 2026-2027

The North Carolina Independent Colleges and Universities (NCICU) Undergraduate Research Program provides funding for undergraduate research in science, technology, engineering, and mathematics. The program was created to encourage students to pursue careers or advanced degrees in STEM fields and to promote greater diversity by making it possible for students, including underrepresented students (new American, low-income, first generation, and/or minority college students) to participate in undergraduate research opportunities. The awards are funded by the NCICU Undergraduate Research Endowment. The endowment was established through a gift from the North Carolina GlaxoSmithKline Foundation and other corporate and foundation entities.

The following students have been awarded North Carolina Independent Colleges and Universities (NCICU) Undergraduate Research Grants for 2026-2027:

Student name: Anathea Ball **Faculty advisor:** Eric Griffin **College/University:** Warren Wilson College	**Student name:** Kayla Parker **Faculty advisor:** Torrence Gill **College/University:** Chowan University
Student name: Lashae Brown, Adam Harvey, Elise Langer **Faculty advisor:** Lisa Bonner **College/University:** William Peace University	**Student name:** Emily Parris **Faculty advisor:** Jennifer Blush **College/University:** William Peace University
Student name: Gage Caldwell **Faculty advisor:** Joshua Holbrook **College/University:** Montreat College	**Student name:** Sienna Ransford **Faculty advisor:** Andrea Perreault **College/University:** Elon University
Student name: Megan Hobbs **Faculty advisor:** Jennifer Blush **College/University:** William Peace University	**Student name:** Alexander Thomas Roberts **Faculty advisor:** Efrain Rivera-Serrano **College/University:** Elon University
Student name: Anna Holcombe **Faculty advisor:** Kyung-Hoon Lee **College/University:** Chowan University	**Student name:** John Strebel **Faculty advisor:** Anne-Marie Iselin **College/University:** Elon University
Student name: Willow McCammon **Faculty advisor:** Joshua Holbrook **College/University:** Montreat College	**Student name:** Alaina Vrable **Faculty advisor:** Ashley Bennett **College/University:** Barton College
Student name: Mac McConnell **Faculty advisor:** Kathy Matera **College/University:** Elon University	**Student name:** Jacob White **Faculty advisor:** Meredith Rowe **College/University:** Gardner-Webb University
Student name: Bronwyn Mulvaney **Faculty advisor:** Kim Epting **College/University:** Elon University	**Student name:** Precious Khan Wondzi **Faculty advisor:** Jing Ye **College/University:** Salem College

Time	Event/Session
8:30 AM – 11:30 AM	**Registration & Check-In**
9:15 AM – 9:45 AM	**Welcome & Opening Remarks**
9:15 AM	Conference Hosts Welcome by Lance Barton & Amber Griffin
9:25 AM	Tracie Clark, Sr. VP of Strategy, Talent, & IE, Central Piedmont
9:35 AM	John Daniels, Vice Chancellor of Research, UNC Charlotte
9:45 AM – 10:10 AM	**Keynote Address**
9:45 AM	Speaker Introduction
9:50 AM	Karen Resendes, President, Council on Undergraduate Research
10:15 AM – 3:30 PM	**Graduate School Fair Open**
10:15 AM – 11:30 AM	**Concurrent Presentations Session 1**
10:15 – 11:30 AM	Poster Session 1
10:30 - 11:30 AM	Oral & Performance Session 1
10:30 - 11:15 AM	Professional Development Workshop 1
11:30 AM – 12:15 PM	**Lunch Break (served 11:30am - 1:00pm)**
12:15 PM – 1:30 PM	**Concurrent Presentations Session 2**
12:15 - 1:30 PM	Poster Session 2
12:30 - 1:30 PM	Oral & Performance Session 2
12:30 - 1:15 PM	Professional Development Workshop 2
1:30 PM – 2:45 PM	**Concurrent Presentations Session 3**
1:30 - 2:45 PM	Poster Session 3
1:45 - 2:45 PM	Oral & Performance Session 3
1:45 - 2:30 PM	Professional Development Workshop 3

2:45 PM – 4:00 PM	**Concurrent Presentations Session 4**
2:45 - 4:00 PM	Poster Session 4
3:00 - 4:00 PM	Oral & Performance Session 4
3:00 - 3:45 PM	Professional Development Workshop 4
4:00 PM – 4:15 PM	**Reflections & Closing Celebration**

Support our Partners/Exhibitors





































Workshop Information (Preregistration Required)

Workshop 1 (Start your graduate school journey and join us for our session, "Grad School 101: Start Your Program Search with Confidence." This information session is designed to guide you through the initial steps of the grad school search process. Learn how to identify programs that align with your academic and career goals, understand the application timelines, and gather valuable insights on how to make informed decisions about your future. Don't miss this opportunity to start your grad school search on the right foot!) 10:30-11:15am: https://gradapp.charlotte.edu/register/?id=d850110a-cd63-465f-b407-5321decfed8c

Workshop 2 (Learn how to translate your undergraduate research experience into skills and accomplishments that stand out. This session will help students identify transferable skills gained through research and communicate their contributions effectively on resumes and in interviews. Students will explore how their research experience can support their pursuit of employment or graduate education. Attendees will leave with practical strategies for articulating the value of their research beyond the classroom.) 12:30-1:15pm: https://gradapp.charlotte.edu/register/?id=5785217a-d20f-4a89-9aa9-b6947d16b758

Workshop 3 (Take your research beyond the conference by learning how to share your accomplishments and expand your professional network on LinkedIn. This workshop will introduce strategies for building your career brand, connecting with mentors and industry professionals, and turning research experiences into meaningful career opportunities.) 1:45-2:30pm: https://gradapp.charlotte.edu/register/?id=7d500473-d93d-4e7b-b021-541e14a84857

Workshop 4 (Addressing the personal and psychological side of graduate education. Areas of focus include: 1) Overcoming Impostor Syndrome in research environments; 2) Strategies for maintaining work-life balance, mental wellness, and avoiding research burnout; 3) Building a peer support network and navigating institutional resources as a graduate scholar.) 3pm-3:45pm: https://gradapp.charlotte.edu/register/?id=3d75b260-b7f5-4ddb-896e-8b0852a6003a

Thank you for participating in SNCURS 2026!

Congratulations on your participation in the 22nd State of North Carolina Undergraduate Research and Creativity Symposium. We hope you enjoyed the event and had a valuable experience.

Please take a few minutes to complete our post-event feedback survey and share your thoughts. Your feedback helps us understand what worked well, and how future SNCURCS events could be improved.



Thank you for being a part of the event!

Session #1 Presentations

10:15 - 11:30 AM

Oral Presentations

Poster Presentations

	Title	Authors	Institution	Mentor	Discipline
CHHS 122	From Discharge to Recovery: Barriers Faced by Individuals Experiencing Homelessness	Maurelle Moowad	University of North Carolina at Charlotte	Dr. Vania Bredy	Nursing and Public Health
	Validating an Automated Docking Pipeline for Antibody Cross-Reactivity Across Viral Families	Srikritha Kosuri	University of North Carolina at Charlotte	Denis Jacob Machado	Computer Science
	Is MyPlate Really for Everyone? A Critical Examination of MyPlate Through a Cultural Lens	Makaylee Sanders	Campbell University	René Ibarra	Cultural Studies
	The Ethical Governance of Regenerative Medicine and Technological Advancement	Trenton Brooks	University of North Carolina at Charlotte	Sharon Bullock	Interdisciplinary Studies

	Title	Authors	Institution	Mentor	Discipline
CHHS 289	Designing and Synthesizing a Small Molecule Inhibitor of Schistosoma Mansoni Phenoloxidase to Inhibit Sclerotization	Alaina Roberts	North Carolina School of Science and Mathematics	Michael Bruno	Biochemistry
	Enzymatic Impacts on Sweetness and Preferences of Sweetpotato Milk	Cynwonthia Poon, Cameron Whitfield, Sifora Tekeste	Appalachian State University	Dr. Brett Taubman and Daniel Parker	Biochemistry
	Differences in the Epigenetic Landscape of Diffuse Large B-Cell Lymphoma (DLBCL) and Hodgkins Lymphoma (HL) as Compared to Healthy Immune Cells	Theodore Pawlik	Elon University	Andrea Perreault	Biochemistry
	Design and Synthesis of a Novel Chalcone-Based Therapeutic Both Early and Late-Stage Alzheimer's Disease	Preston Cosby	North Carolina School of Science and Mathematics	Michael Bruno	Biochemistry

	Title	Authors	Institution	Mentor	Discipline
CHHS 294	The Transformation of FEMA and how Communities Effect the way the Department Operates	Ashley Marshall	North Carolina School of Science and Mathematics	Marcelo Aranda	Social Work and Human Services
	Breaking the Cycle: Understanding How Domestic Violence Goes Unaddressed and Identifying Ways to Increase Change	Macayla Gay	North Carolina School of Science and Mathematics	David Cantrell	Social Work and Human Services
	Advancing Immigrant Inclusion and Economic Mobility in Charlotte's Early Childhood Workforce	Rhonda Campbell	University of North Carolina at Charlotte	Stephanie Potochnick	Sociology
	Factors that Contribute to the Academic and Social Success of First-Generation College Students	Shameer Garrett	University of North Carolina at Charlotte	Amy Peters	Sociology

	Title	Authors	Institution	Mentor	Discipline
CHHS 295	Cocktail-Optimized Organic Acid Systems for Calcium and Carbon Transformation	Mihika Kiran	North Carolina School of Science and Mathematics	Michael Bruno	Environmental Science and Sustainability
	Evaluating Responses to Natural Extract Treatments in Arabidopsis thaliana Infected With Pseudomonas syringae pv. tomato	Warren Nicholson	North Carolina School of Science and Mathematics	Jennifer Williams	Environmental Science and Sustainability
	Catalytic Alkylation of Lignin-Derived Phenolics with 5-Hydroxymethylfurfural for SAF Intermediate Production Using Modified ZSM-5s	Aanya Prashanth	North Carolina School of Science and Mathematics	Tim Anglin	Environmental Science and Sustainability
	Comprehensive Assessment of Water Quality Parameters and Hydrochemical Dynamics in Raleigh Wetlands	Avani Shrestha	North Carolina School of Science and Mathematics	Christine Goforth	Environmental Science and Sustainability

	Title	Authors	Institution	Mentor	Discipline
Mebane 102	The Evil On Stage: The Sexualization Of Women In Performing Arts	Melanie Salinas	North Carolina School of Science and Mathematics	David Cantrell	Dance
	The "Americanization" of Bossa Nova: How the Girl from Ipanema Lost Her Way	Jackson Vliet	North Carolina School of Science and Mathematics	Chad Cygan	Music
	Mind Shift	Natalee Balestra	High Point University	Christine Stevens	Dance

	Title	Authors	Institution	Mentor	Discipline
Mebane 103	Online First, Not Online Only	Jacob Grimes, Kaden Saurer	Queens University of Charlotte	Steven Cox	Business
	Who Gets to Decide? Black Community Authority in Race-Based Clinical Algorithms	Dwight Vauters	North Carolina School of Science and Mathematics	David Cantrell	Interdisciplinary Studies
	Evaluation of Elicit AI's Ability to Replicate a Published Meta-Analysis	John Strebel	Elon University	Anne-Marie Iselin	Psychology
	Invisible Strings: The Hidden Influence of Parental Psychological Control on Adolescent Emotion and Behavior	Kaily Agueda	University of North Carolina at Charlotte	Ariana Shahinfar	Psychology

	Title	Authors	Institution	Mentor	Discipline
Mebane 201	Engineering a Localized Eupatilin-Loaded Zn-EGCG-Chitosan Nanocomplex to Mitigate Effects of Acute Innate Graft Rejection in Crassostrea virginica (Eastern Oysters)	Lema Tohnya	North Carolina School of Science and Mathematics	Heather Mallory	Biology
	INVESTIGATING VERRUCOMICROBIOTA SPECIES ABUNDANCE AS A BIOMARKER FOR EARLY DETECTION OF EQUINE GASTROINTESTINAL DYSBIOSIS	Kristian Smith	Catawba College	Carmony Hartwig	Biology
	From Hormone to Drug: Understanding GLP-1	Violet Porterfield	North Carolina School of Science and Mathematics	David Cantrell	Biology
	A Moth Bucket List: A Survey of Nocturnal Lepidopterans in the North Carolina Piedmont	Baydn Sweatt	Catawba College	Joseph Poston	Biology

	Title	Authors	Institution	Mentor	Discipline
Mebane 202	Mapping Prejudice, Guilford County	Juleigh Harris, Monica Miller, Lucas Mendoza-Gonzalez	High Point University	Paul Ringel	History
	Commemorative Practices in Berlin, Honolulu, and Tokyo/Hiroshima since 1945	Matthew Brantley	Elon University	Andrea Sinn	History
	Battle in the Bull City: The Long Fight for Desegregation in Durham Public Schools	Zora Lentz	North Carolina School of Science and Mathematics	David Cantrell	History
	Mapping the Loss of Hayti: Redlining, Redevelopment, and Black Community Life in Durham	Max Bao-Dai	North Carolina School of Science and Mathematics	David Cantrell	History

	Title	Authors	Institution	Mentor	Discipline
Mebane 203	Analysis of Fluid Mechanics using Piezoelectrically Generated Acoustic Waves	Carmela Rogers-Gonzalez	North Carolina School of Science and Mathematics	Tandy Grubbs	Chemistry
	Synthesizing and Evaluating Racemic ?-Lipoic Acid Loaded Sodium Alginate-Carboxymethylcellulose Hydrogel Beads for Controlled pH-Responsive Delivery	Aarohi Salaria	North Carolina School of Science and Mathematics	Tandy Grubbs	Chemistry
	The Influence of Oil-Based Fixatives on Perceptions of Fragrance Longevity	London Jackson	North Carolina School of Science and Mathematics	David Cantrell	Chemistry
	Re-evaluating Food Access Across North and South Carolina	Andrew Simmons	University of North Carolina at Charlotte	Jordan Blekking	Geography/Geology

	Title	Authors	Institution	Mentor	Discipline
Mebane 165	GreenFlow LLC: Development of Biodegradable PHA-Based Menstrual Applicators for Sustainable Women's Health	Silvia Gusmati	Elon University	Christy Benson	Biology
	Co-Application of Kudzu-derived Biochar and Bacillus velezensis Synergistically Mitigate Salt Stress in Setaria italica via Rhizosphere and Plant Mechanisms	Colin Henry	North Carolina School of Science and Mathematics	Jennifer Williams	Biology
	The Effects of Plant Extracts on the Growth of Strepptococcus Pneumoniae	Moorea Barbee	High Point University	Tahl Zimmerman	Biology
	Attenuating Developmental Delays with Bacopa monnieri Extract in a Drosophila melanogaster Model of Fragile X Syndrome	Anshita Bhunia	North Carolina School of Science and Mathematics	Jennifer Williams	Biology

	Title	Authors	Institution	Mentor	Discipline
Mebane 166	Phising Abstract	Michael Woods	Fayetteville State University	Longfei Wu	Computer Science
	Which is better: Expert curated knowledge base or general purpose LLM	Aaron Joseph	North Carolina School of Science and Mathematics	Berndt Mueller	Computer Science
	A Comparative Analysis of Large Language Model Response Consistency Under Semantically Equivalent Prompt Variations	Yuvika Vashisth	North Carolina School of Science and Mathematics	Alok Kumar	Computer Science
	Toward Automated Monitoring of Augmented Reality Guidance and User Safety Using Large Multimodal Models	Alisha Varshney	North Carolina School of Science and Mathematics	Maria Gorlatova	Computer Science

	Title	Authors	Institution	Mentor	Discipline
Mebane 168	The Outsider's Dilemma: Epistemic Responsibility and Competing Interpretations of Religious Experience	Rishi Jasti	North Carolina School of Science and Mathematics	David Cantrell	Philosophy, Ethics, and Religious Studies
	Exploring Matter and Meaning: Quantum Mechanics Between Karen Barad and Bill Brown	Hannah Oh	North Carolina School of Science and Mathematics	David Cantrell	Philosophy, Ethics, and Religious Studies
	The Night Sublime	Aniketh Vallabhajosyula	North Carolina School of Science and Mathematics	David Cantrell	Philosophy, Ethics, and Religious Studies
	North Carolina Medicaid Dental Reimbursement Rates for Children Ages 0-20: A Comparative Analysis Across Nine States	Aaryan Patel	University of North Carolina at Chapel Hill	Caroline Sawicki	Nursing and Public Health

	Title	Authors	Institution	Mentor	Discipline
Mebane 169	The Evolution of Women's Rights in Afghanistan	Thanushri Baskar	North Carolina School of Science and Mathematics	David Cantrell	Law and Legal Studies
	Black Liberation Theology; A Synthesis of Black Christianity and Black Power in the Civil Rights Movement	Titus Henry	University of North Carolina at Charlotte	Aaron Hooker	Philosophy, Ethics, and Religious Studies
	The Rights Violations and Transitional Justice Outcomes Cross-National Dataset	Saanvi Kumar	North Carolina School of Science and Mathematics	Mara Revkin	Law and Legal Studies
	Beyond a Reasonable Doubt: The Evolution, Application, and Evaluation of the Standard in Criminal Jury Decision-Making	Abbey Beam	University of North Carolina at Charlotte	Tiffany Berzins	Law and Legal Studies

Title	Presenters	Institution	Mentor	Discipline
100: Why Telling an LLM Who You Are Doesn't Help It Predict What You Think	Charlestone Mayenga	North Carolina A&T State University	David Jurgens	Computer Science
101: A Qualitative Case Study of Leadership Development and Sense of Belonging Among First-Generation, Low-Income Junior and Senior Undergraduates in High-Impact Practices	Tan Francis	North Carolina State University	Courtney Simpson	Education
102: Correlation between meat consumption and health and environmental knowledge among undergraduate students	Carolynn Christopher	Elon University	Kelsey Bitting	Environmental Science and Sustainability
103: Herpetofauna Habitat Assessment in the South Carolina Piedmont	Isabella Sherman	Queens University of Charlotte	E. Davis Carter	Environmental Science and Sustainability
104: Social Workers' Perceptions of the Benefits, Risk, and Ethical implications of Artificial Intelligence in professional practice	Alivia Ingram	Meredith College	Paige Moore	Social Work and Human Services
105: Spatial Equity in Electric Vehicle Charging Infrastructure: Assessing Displacement Vulnerability Across Charlotte's Neighborhood Profile Areas	Rose Exum	University of North Carolina at Charlotte	Dr. Marco Scipioni	Environmental Science and Sustainability
106: Demonstration of Schottky-Source ?-Ga2O3 Vertical Static Induction Transistor by TCAD	Seunghyeon Bang	North Carolina State University	Saurav Roy	Engineering
107: Microwave Spectroscopy and Analysis of 2,3,4-Trifluorophenol	Hasinne Bonthu, Gandhimathi Sivarajan	Other/Not Listed	Gordon Brown	Chemistry

108: From Experience to Belief: Examining the Relationships Among Adverse Childhood Experiences, Sexual Communication Self-Efficacy, and Rape Myth Acceptance	Emma Flynn, Leland Sanders, Phoebe Dillon	High Point University	Kirsten Li-Barber	Psychology
109: Changes in Antibody Binding Capability of S. aureus Clinical Isolates Throughout Chronic Infections	Kailey Zimmer	Elon University	Eryn Bernardy	Biology
110: Mapping The Human Facial Microbiome. Investigating Spatial and Interindivdual Variations	Natalie Bradford, Francisco Camacho	Catawba College	Francisco Camacho	Biology
111: The Effect of Social Media on College Students' Well-Being	Lydia Smith	Gardner-Webb University	Ivelina Naydenova	Psychology
112: Print-to-Sense: Additive Manufacturing of Tactile Sensor Tiles	Ashli Gortman	University of North Carolina at Charlotte	Marjan Molavi-Zarandi	Engineering
113: Producing gRNA Inserts for Regulation of Genes Associated with Obesity	Cole Lapcevic	Wake Technical Community College	Caroline Hoffman	Biology
114: Following the Electrons: Linking Cyclic Voltammetry and Quenching	Angela Alozie	University of North Carolina at Charlotte	Dr. Michael Walter	Chemistry
115: Enhancement of Plasma-Wave Resonance in GaN HEMTs through Dispersive Ferroelectric Gate Dielectrics	Lincoln Hogan	North Carolina State University	Lincoln Hogan	Engineering
116: Comorbidities and Treatment Patterns in Adult ADHD: A 97-Patient Retrospective Analysis	Khushi Konda	North Carolina School of Science and Mathematics	Devendra Shah	Psychology

117: The Dirt on Equine Asthma: A retrospective study analysis of environmental soil types contributing to equine asthma	Nishika Gandhiraj	North Carolina School of Science and Mathematics	Katie Sheats	Environmental Science and Sustainability
118: ReZo Relaxion Zone	David Diza, Eliezer Valladolid, Sucheta Dharmarajula, Justin Marquis, Iceland Alston	Central Piedmont Community College	Serenity Stokes	Engineering
119: Small World Initiative: Evaluating the Antibiotic Activity of Pseudomonas Aeruginosa Against Staphylococcus Species	Kaylyn Jennings	Wake Technical Community College	Gregory Johnson	Biology
120: Co-Researcher	Eddrelyn Pimentel	Fayetteville State University	Dr. Delores Jones-Brown	Criminology/Criminal Justice
121: Exploring Visual Adaptions in Semi-Aquatic Snakes Using Hydrogel Based Optical Model	Daityn Bost	Catawba College	Bijay Shrestha	Physics and Astronomy
122: Surface characterization of silver-modified resin dental composites	Samantha Bean	Catawba College	Luis Fernandez-Torres	Chemistry
123: Comparative Analysis of Results Using Different Solvents	Su Mon	Wake Technical Community College	Carolyn Hoffman	Biology
124: SuperVac: A Power Relocation System that Focuses on HVAC	Kevin Martinez-Castillo, Nathan Matuasilua, Evan Morgan	Central Piedmont Community College	Carl Arrington	Engineering

125: Sparsity under Stress: Evaluating Capacity-Constrained Matching Efficiency in Sparse Networks	Hemanth Nallagatla	North Carolina School of Science and Mathematics	Xiaochun Niu	Computer Science
126: Geminiviruses infectious clone production from solanaceous plants	Matthew Lim	North Carolina State University	Trino Ascencio-Ibáñez	Biochemistry
127: ADHD: Differences in Academic Skills, Brain Activity, and Cognition	Eva Richardson	High Point University	Daniel Krenzer	Psychology
128: Comparative Evaluation of Object Detection Methods on Stereoscopic Distance Estimation	Oviya Selvakumar	North Carolina School of Science and Mathematics	Amirhossein Ghasemi	Computer Science
129: Evaluating the extent to which prescribed burns affect plant and bird diversity	Xander Brice, Aashvi Sheliya, Jonah Pil	North Carolina State University	Zakiya Leggett	Environmental Science and Sustainability
130: Exploring how early social-emotional protective factors and home language development predict growth in English literacy among multilingual learners	Wicharporn Bunlue	University of North Carolina at Charlotte	Andrew Gadaire	Psychology
131: Reducing Seizure Risk in Glioblastoma Through PVSRIPO-Enhanced EAAT2 Expression in Tumor Macrophages	Sophia Cosmello	North Carolina School of Science and Mathematics	Matthias Gromeier	Biology
132: Improving the Processability of High-Performance TVT-based Polymers through Side Chain Engineering	Kate Hannah	University of North Carolina at Asheville	Jeromy Rech	Chemistry

133: The Correlation Between Unified Parkinson's Disease Rating Scale Score and Power Spectral Density in Parkinson's Disease Using EEG Imaging Data	Elizabeth Isenbarger	University of North Carolina at Chapel Hill	Rosie Dutt	Computer Science
134: Assessing Ecosystem Services in Native vs. Ornamental Botanical Gardens at High Point University	Josephine DeRosa, Alexander Ray, Malee Vass	High Point University	Megan Bowman	Biology
135: Picturing the Metaphor: Comparing Prompting Strategies for AI-Generated Companion Images to Support Cross-Disciplinary Reading	Dominique Sanchez	University of North Carolina at Charlotte	Matin Yarmand	Computer Science
136: Experiments on the Structural Response of a Transonic Truss Braced Wing	Sadhana Subramanian	North Carolina School of Science and Mathematics	Earl Dowell	Engineering
137: Recognizing Abuse: IPV Knowledge and Perceptions Among Black Women	Zharia Deese	Fayetteville State University	Erica Campbell	Social Work and Human Services
138: American ginseng as a modulator of tau clearance via the autophagy-lysosomal pathway	Julia Ringel	University of North Carolina at Chapel Hill	Jonathan Schisler	Biology
139: Immigrant Integration in the Queen City: Cross-Sector Coalitions and Local Integration Capacity in Charlotte, North Carolina	Sebastian Ramirez	Queens University of Charlotte	Margaret Commins	Political Science
140: A little goes a long way; a study in SE Raleigh, NC by Aurelien Fradin, Dr. Angela Allen, Sarah Brim	Aurelien Fradin	North Carolina State University	Angela Allen	Environmental Science and Sustainability

141: A Sweet Kiss: Exploring the Bacterial Similarities of Couples Using Tongue Dorsum Saliva Samples	Breann Wusterbarth	Catawba College	Dr. Francisco Camacho	Biology
142: Characterization of Ge and GeSn samples via Photoluminescence Spectroscopy	Daniel Harris	University of North Carolina at Charlotte	Jay Mathews	Physics and Astronomy
143: Characterization of the surface morphology of resin dental composites	Breann Wusterbarth	Catawba College	Luis Fernandez-Torres	Chemistry
144: Investigating the role of cognitive hierarchical relationships on color-concept associations	Rana Gabrielle Ligue	High Point University	Melissa Schoenlein	Psychology
145: Microwave-Assisted Synthesis of Indolizines from 1H-Pyrrolo[3,4-b]pyridine Scaffolds	Aisha Yakubu	Winston-Salem State University	Sezgin Kiren	Chemistry
146: Implementation of Wearable-Based Remote Monitoring in Outpatient Physical Therapy: A Mixed-Methods Pilot Implementation Study	Ava De Simone, Gracie Callahan	High Point University	Jason Pelletier	Physical/Occupational Therapy and Speech Language Pathology
147: Advanced Manufacturing: Rapid Assembly	Matali Fields, Enijah Linville, Benjamin Major, Aisa Young & Jayson Vo	Forsyth Technical Community College	Tandeka Boko	Engineering
148: Curating and Visualizing Environmental Pesticide Exposure Compounds from Public Metabolomics Data	Faith Bailey	North Carolina School of Science and Mathematics	Collyn Gaffney	Biology
149: Spatial Analysis of Toxic Soil Metals Around Historic Buildings in Durham, North Carolina	Lily Fang	North Carolina School of Science and Mathematics	Daniel Richter, Anselme Dossou	Environmental Science and Sustainability

150: Social Information Processing and Inequality	Jada Clark, Ryleigh Knox	University of North Carolina at Charlotte	Lisa Walker	Sociology
151: Does Warning Format Affect Phishing Detection? A Hybrid Risk-Scoring System and Controlled Human Factors Study	Arjun Patel	North Carolina School of Science and Mathematics	Collyn Gaffney	Computer Science
152: Perimenopause: Advancing Health Literacy, Patient Education, and Reducing Stigma Through Community-Based Education	Khushi Rathod	University of North Carolina at Charlotte	Jessamyn Moxie	Nursing and Public Health
153: Where to Next? Tourism in Kazakhstan	Alexandra Ugoji	North Carolina School of Science and Mathematics	David Cantrell	Anthropology and Archaeology
154: From Interactome to Intervention: Systems-Level Therapeutic Pipeline with ML-Driven Hub Gene Prioritization and Polypharmacological Drug Discovery in Ischemic Stroke	Rishidharan Jayakumar	North Carolina School of Science and Mathematics	Dr. Chandrabose Selvaraj	Biology
155: Effects of Urban Canopy Cover on Avian Activity and Species Diversity	Brooklynn Stewart	Gaston College	Marguerite Bishop	Biology
156: Health Inequalities in South Africa: How HIV Policy Interventions Impact HIV Incidence Rates in the Western Cape and KwaZulu-Natal	Naami Abbey	University of North Carolina at Charlotte	Stephanie Norander	Sociology
157: The Impact of a Nature-based Mindfulness Practice on Undergraduate Student Outcomes	Kiley Sherlock	Elon University	Kelsey Bitting	Environmental Science and Sustainability

158: The Heptagram Problem: How Linear Algebra and Symmetry Can Be Used To Search For 7-Point Magic Stars	Aditya Choubey	North Carolina School of Science and Mathematics	Harold Reiter	Mathematics
159: Antibiotic Extraction from Soil Bacteria: Comparing Chloroform and Ethyl Acetate	Ngoc Tran	Wake Technical Community College	Carolyn Hoffman	Biology
160: Banking on Gen Z: How Ally Bank Can Connect with the Next Generation	Kiley Pappas, Brynn Fogarty	Queens University of Charlotte	Steven Cox	Business
161: Antibiotic Resistance: Evaluating Antimicrobial Properties of Soil Microbes Found in Human-Influenced Soils	Nikhil Sai Gatla, Yuliia Adamovych	South Piedmont Community College	Chasity Moore	Biology
162: Parental Psychological Control and Adolescent Depressive Symptoms in Chinese Families: The Roles of Parent-Parent Gender Dyad	Jordan Krause, Shanhong Luo	Fayetteville State University	Shanhong Luo	Psychology
163: Breaking the Banking Barrier: Understanding What Drives Gen Z to Switch Banks	Bianca Wettel, Evan Hart , Danielle Ngongo	Queens University of Charlotte	Steven Cox	Business
164: Implicit Bias and Formerly Incarcerated Women	Lindsey Drew	Meredith College	Candalyn Rade	Psychology
165: Human Activity Recognition Using mmWave Wireless Signals and Deep Learning	Harri SN	North Carolina School of Science and Mathematics	Hongfei Xue	Computer Science
166: Evaluating FAP Activity and FAP-Dependent Ponatinib Prodrug Activation in Myeloid Leukemia	Brooklynn Devettori	Queens University of Charlotte	Lawrence Druhan	Biochemistry

167: Examining Organizational and Behavioral Factors of AI Adoption in Healthcare	Samantha Owens	Elon University	Vinayaka Gude	Health and Human Development
168: Novel Synthesis Route for 2,7-dibromopyrene-4,5,9,10-tetraone and Exploring Routes for 2,7-diiodopyrene-4,5,9,10-tetraone and 1,2,3,6,7,8-hexaiodopyrene-4,5,9,10-tetraone	Ahnaf Azad	North Carolina School of Science and Mathematics	Aleks Prokofjevs	Chemistry
169: The Expansion of Life, Businesses, and Infrastructure in Charlotte	Mikaria Hunt	University of North Carolina at Charlotte	Cindy Gilson	Sociology
170: Search for Antimicrobial-Producing Bacteria in an NC Coastal Wetland	Parker Moffa, Hasan Ali	Campbell University	Leila Reyes-Ruiz	Biology
171: Lip Syncs and Lifelines: How Drag Artists Foster LGBTQ+ Acceptance and Community	Kylie Greenelsh	University of North Carolina at Charlotte	Travis Scheadler	Social Work and Human Services
172: Take a Breath:	Tais Moore	North Carolina A&T State University	LaBarron Hill	Psychology
173: Effects of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Exposure on Gene Expression, Oxidative Stress, and Neurodevelopmental Markers	Sanvi Pandit	North Carolina A&T State University	Ashley King-Bennett	Biochemistry
174: Countering Social Harm: Acceptability & Feasibility of an Adapted LGBTQ+-inclusive Violence Prevention Training	Yasmine Paige, Parth Vyas, Kai Norris	University of North Carolina at Charlotte	Jessamyn Moxie	Health and Human Development

175: Compensatory Spectacle: Masculinity in "The Good, the Bad and the Ugly," Within Its Italian Cultural Context	Bella Yuan	North Carolina School of Science and Mathematics	David Cantrell	Film/Photography Studies
176: From Feedback to Action: Student and Expert Perspectives on Bystander Intervention Measures for Problematic Alcohol Use	Jianaa Ghosh, Anne Jane Campbell	University of North Carolina at Charlotte	Annelise Mennicke	Psychology
177: G. bulloides size-depth distribution within an Oxygen Minimum Zone	Jaylin Halim	Wake Technical Community College	Sara Rutzky	Geography/Geology
178: Precise RNA Editing of TDP-43 for Familial ALS	Keith Tu	North Carolina School of Science and Mathematics	Mitchell Yip	Biology
179: Resurrecting Camp Greene: Digital History of WWI Charlotte	Jack Hayes	University of North Carolina at Charlotte	Heather Perry	History
180: Extraversion and Gender as Predictors for Sexist Attitudes.	Chanel Washington	Fayetteville State University	Erin Moeser-Whittle	Psychology
181: Comparing Perfluorocarbon Formulations and Their Effects on BCI Airway Epithelial Cell Viability	Sai Sraddha Chaganti	North Carolina School of Science and Mathematics	Brian Button	Biochemistry
182: Comparison of Antimicrobial Substances Present in Varying Levels of Soil Disturbances	Anna Hernandez, Momo Kong, Mac Looney	South Piedmont Community College	Chasity Moore	Biology
183: Neural Network Prediction of Cut Depth for Robotic Laser Surgery	Eric Zheng	North Carolina School of Science and Mathematics	Leila Bridgeman	Computer Science
184: Coyote Detection and Activity Patterns Across Natural and Recreational Landscapes	Madison Owen	University of North Carolina at Charlotte	Sara Gagne	Environmental Science and Sustainability

Session #2 Presentations

12:15 - 1:30 PM

Oral Presentations

Poster Presentations

	Title	Authors	Institution	Mentor	Discipline
CHHS122	Charlotte: The Ever-Changing City: A Literature Review	Jennifer Garcia Torres	University of North Carolina at Charlotte	Kyle Spence	Architecture, Construction Management, and Interior Design
	Understanding the Power of Sleep	Jarod Brown	University of North Carolina at Charlotte	Debra Booton	Psychology
	Gendered Racial Microaggressions, Stress, and Dementia Risk in Black Women	Jada Clark	University of North Carolina at Charlotte	Candace Brown	Psychology
	Childhood Onset Schizophrenia and the Factors that Lead to a Low Diagnostic Rate	David Boswell-Samuels	University of North Carolina at Charlotte	Jimmy Green	Psychology

	Title	Authors	Institution	Mentor	Discipline
CHHS 285	Bayesian integrative approach identifies hidden intermediates in DH270-induced structural transitions of HIV-1 Envelope	Alaina Vrable	Barton College	Ashley Bennett	Biochemistry
	Computational Design and Experimental Validation of a Reversible Dual MAO-A/MAO-B Inhibitor for Parkinson's Disease	Chigozie Obi	North Carolina School of Science and Mathematics	Timothy Anglin	Biochemistry
	Optimizing Ascorbic Acid and Tannic Acid Dual-Coated Silver Nanoparticle Synthesis to Inhibit Oxidation and Enhance Antibacterial Effects	Elyse Rea	North Carolina School of Science and Mathematics	Tandy Grubbs	Biochemistry
	Project C.A.R.E. Community Engaged Research	Celia Gully	Western Carolina University	Caitlin Torrence	Nursing and Public Health

	Title	Authors	Institution	Mentor	Discipline
CHHS 289	Design and 3D Printing of Smartwatch and Display Housings for GRID-AIR	Iris Bellamy, Joshua Jones	East Carolina University	Morteza Nazari Heris	Engineering
	AeroSleeve: A Passive Acoustic Sleeve for Smartphone Detection of Metered-Dose Inhaler Technique Errors	Aayush Chayan, Shishir Maddineni	North Carolina School of Science and Mathematics	Krishi Chayan	Engineering
	Distributed Ionogel Proprioception in a Kirigami Pneumatic Actuator	Rishi Jasti	North Carolina School of Science and Mathematics	Hanbin Choi	Engineering
	Impact of Algorithm Optimization Techniques	Egor Maximenko	High Point University	Luis Cueva Parra	Mathematics

	Title	Authors	Institution	Mentor	Discipline
CHHS 294	An Analytical Home-Run: How Predictive Analytics on Batting Statistics Have Impacted Improving Baseball Teams	Cade Gaskill	University of North Carolina at Charlotte	Bienvenido Rodriguez-Medina	Interdisciplinary Studies
	The Creative Greenhouse: Exploring How Cities are the Perfect Conditions for Growing Innovation	Emsley Jackson	University of North Carolina at Charlotte	Cindy Gilson	Interdisciplinary Studies
	The Role of the Gut Microbiome and Nutrition in Preeclampsia	Grayce Jeter	University of North Carolina at Charlotte	Dr. Alicia Dahl	Interdisciplinary Studies
	Substance Use and Pregnancy	Kriti Palaparthy, Sonika Pattila	University of North Carolina at Charlotte	Kennicia Fortson	Interdisciplinary Studies

	Title	Authors	Institution	Mentor	Discipline
CHHS 295	Before the Exam Room: Internalized Racial Scripts and Patient Behavior Among Black Americans	Preston Cosby	North Carolina School of Science and Mathematics	David Cantrell	Gender, Ethnicity, Diversity, or Cultural Studies
	The Uzbek Kelin: Patriarchy Beyond Islam	Shadiya Urmanova	North Carolina School of Science and Mathematics	David Cantrell	Gender, Ethnicity, Diversity, or Cultural Studies
	How Do We Activate Power When We're Sitting With the Provider	Saniya Young	University of North Carolina at Charlotte	Nicole Peterson	Anthropology and Archaeology
	Structural Barriers to Anxiety Care Among Rural African American Youth: A Biopsychosocial Review	Jeredine Sumo	University of North Carolina at Charlotte	Suzanne Boyd	Interdisciplinary Studies

	Title	Authors	Institution	Mentor	Discipline
Mebane 102	Songs of Faith and Resilience: The Black Experience Through Art Song	Matthew Cooper	North Carolina Central University	Stephen Stacks	Music
	Globalization, Beauty Ideals, and Consumer Awareness in the Cosmetic Industry	Tanushri Ravada	University of North Carolina at Charlotte	Jennifer Stuart	Interdisciplinary Studies
	Art Therapy Applications within Pediatric Medicine	Harshita Verma	University of North Carolina at Charlotte	Kaleb Thompson	Interdisciplinary Studies

	Title	Authors	Institution	Mentor	Discipline
Mebane 103	Mechanistic Origins of Biopolymer Gelation Dynamics and Network Topology	Dylan Miller	East Carolina University	Nathan Hudson	Physics and Astronomy
	On the Impact of Initial Entanglement in a Two-Spin Open Quantum System	Christian Schefer	University of North Carolina at Charlotte	Donald Jacobs	Physics and Astronomy
	Design, Simulation, and Experimental Characterization of a Low Reynolds Number Micro Wind Turbine in Turbulent Wind Regimes	Michael Zhang	North Carolina School of Science and Mathematics	James Happer	Physics and Astronomy
	MARS: A Tool Mediated AI Framework for Observational Astronomy	James Atkisson	University of North Carolina at Chapel Hill	Daniel Reichart	Physics and Astronomy

	Title	Authors	Institution	Mentor	Discipline
Mebane 201	Coyotes and Sea Turtles: Behavioral Patterns and Predation on Wassaw NWR	Alden Mazo	North Carolina State University	Kristen Zemaitis	Biology
	Investigating the Mycorrhizal Communities of American, Chinese, and F1 Hybrid Chestnut Seedlings with Oxford Nanopore Technology.	Mick Williams	University of North Carolina at Asheville	Jonathan Horton	Biology
	Satb1 and Satb2 form Homodimers and Heterodimers with Each Other	Rebecca Grigg	Wingate University	Brett Schofield	Biology
	Evaluation of Grains of Selim and Honey as Alternative Antimicrobials Against Patient-Derived UTI Bacterial Strains	Noah Torain	Winston-Salem State University	Dr. Akamu Jude Ewunkem	Biology

	Title	Authors	Institution	Mentor	Discipline
Mebane 202	The Effects of Time Constraints on Moral Decision Making	Tianna Haskett	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	A Comparison of the Effects of Mindfulness Meditation, Coloring, or Both on State Anxiety Among College Students	Aprayer Johnson	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	Mental Health and Athletic Performance: The Impact of Therapy on Athletes	Megan Hobbs	William Peace University	Jen Blush	Psychology
	Belief and Blackness.	Faith Bailey	North Carolina School of Science and Mathematics	David Cantrell	Philosophy, Ethics, and Religious Studies

	Title	Authors	Institution	Mentor	Discipline
Mebane 203	Humanity and Artifice: How Jane Austen's Fictional Letters Pair Artificiality with Virtue	Kathryn Helms	Davidson College	Hudson Vincent	English and Literature
	The Digital News Cycle: Opportunities and Challenges in Production, Distribution, and Consumption	Sophie Parker	North Carolina School of Science and Mathematics	David Cantrell	English and Literature
	The Anatomy of an Apology	Lola Moore	Elon University	Drew Perry	English and Literature

	Title	Authors	Institution	Mentor	Discipline
Mebane 165	The Role of Fusion Proteins in the Progression of Pilocytic Astrocytoma to Glioblastoma	Sienna Ransford	Elon University	Andrea Perreault	Biology
	Modeling Hypoplastic Left Heart Syndrome with Patient-Derived Induced Pluripotent Stem Cells to Investigate EFNA1/EphA Signaling	Sophie Davis	East Carolina University	Jitka Virag	Biology
	Long COVID: An Autoimmune Condition?	Sudarshan Praveen	East Carolina University	Eric Anderson	Biology
	Developing and Growing Zebrafish for Biological Research	Anjana Ramanujam, Gia Gia Vo	North Carolina School of Science and Mathematics	Isaac Stewart	Biology

	Title	Authors	Institution	Mentor	Discipline
Mebane 166	Effect of Feedback on Performance of Math Problems in College Students	Madison Henderson	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	The Effect of Time Pressure on Cognitive Interference	Paola Gonzalez	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	Neoliberalism 'a la mexicana': Understanding Mexican development debates before the 1982 debt crisis	Stephanie-Xóchtil Garcia-Palma	University of North Carolina at Charlotte	Jürgen Buchenau	History
	Independent in Name Only: Media Labor and Corporate Power in WWE	Nia Jeter	Winston-Salem State University	W. Russell Robinson	Communications

	Title	Authors	Institution	Mentor	Discipline
Mebane 168	Effect of Macrophage Polarization on Lipid Uptake and Foam Cell Formation	Brittany Johnson, Amira Brown	High Point University	Shan Nagarajan	Health and Human Development
	Redefining Autonomy: Subverting Parkinson's Disease Stigma Through Narrative Medicine	Udayan Satapathy	North Carolina School of Science and Mathematics	David Cantrell	Interdisciplinary Studies
	The Cost of Control: How Deep Brain Stimulation Disrupts Identity and Consent	Loshini Talari	North Carolina School of Science and Mathematics	David Cantrell	Interdisciplinary Studies
	Biomechanical Sustainability in Computer Use and Instrumental Performance	Jacob Bell	University of North Carolina at Charlotte	Matin Yarmand	Interdisciplinary Studies

	Title	Authors	Institution	Mentor	Discipline
Mebane 169	The Orphan Train Movement: Emigration as a Cure for Pauperism	Udaya Sri Parthiban, Rasya Kolakaleti , Princess Piamah-Assin,	Guilford College	Chad Philips	History
	French Policy and Foreign Affairs in Latin and Central America Under the Mitterrand Presidency During 1981	Lea Boyens	University of North Carolina at Charlotte	Jurgen Buchenau	History
	Reading Comprehension Among College Students Listening to Jazz Music	Tyland Clark	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	Text Message Interruptions and Reading Comprehension in College Students	Nyia Howard	Elizabeth City State University	Dr. Kulwinder Kaur-Walker	Psychology

Title	Authors	Institution	Mentor	Discipline
100: Impulse By Design	Layla Spaulding	Queens University of Charlotte	Tommy DeRosset	Psychology
101: Determination of the Minimum Inhibitory Concentration of Crude Violacein Extract from Janthinobacterium lividum Against Staphylococcus aureus	Muntahin Hasan Maisha	Meredith College	Susan Gardner	Biology
102: CucurBot: A Novel LLM-based Detection of Cucurbit Diseases Using a Hybrid-Edge Cloud Rover	Vansh Jain, Lucy Wang, Rohan Manargudi	University of North Carolina at Wilmington	Dr. Laavanya Rachakonda	Engineering
103: Investigating the Influence of Wind Forcing on Estuarine Circulation in the Albemarle-Pamlico System Using the General Ocean Model (GOM)	Bradley Arman	East Carolina University	Jungwoo Lee	Environmental Science and Sustainability
104: Evaluating how substrate type influences eastern oyster recruitment and persistence along estuarine shorelines	Scarlett Melgar-Garcia	East Carolina University	Rachel Gittman	Biology
105: The Effect of Ibuprofen on the Movement of C. elegans	Jacob White	Gardner-Webb University	Meredith Rowe	Biochemistry
106: Nitrogen Concentration Dynamics in Coastal Waterfowl Impoundments	Zasha Griffin	East Carolina University	Randall Etheridge	Engineering
107: What Do We Actually Know About Trauma and Epigenetics in African Americans? Tracing Stress from Jim Crow to the Genome.	Teesha Mudliar	North Carolina School of Science and Mathematics	David Cantrell	History
108: Exploring Demodex Mites (Class: Arachnida) on Captive Lemurs (Family: Lemuridae)	Yanisa Keck, Allana Chase, Bryce Bolton, Ryan Hall	North Carolina State University	Lisa Paciulli	Biology
109: Navigating U.S. Special Education: Experiences of	Zoe Brooks, Irene Kessy	University of North	Nicole Adams	Psychology

Congolese Mothers of Children with Disabilities		Carolina at Charlotte		
110: Development and Optical Characterization of an Epidermal Tissue Phantom for Enhanced Thermal Imaging	Zoha Ali	University of North Carolina at Charlotte	Susan Trammell	Physics and Astronomy
111: Physiological and Biomechanical Response to Progressive Swimming Intensity in a Controlled Pool Environment: Implications for Aquatic Safety	Madison Yousey	University of North Carolina at Wilmington	Andrew Harrison	Exercise Science and Nutrition
112: Financial Literacy in College Students	Emma Elliott	East Carolina University	Nikki Chappell	Business
113: Evaluating Barriers and Facilitators to the Implementation of Long-Acting Injectable Buprenorphine in Community Pharmacy Settings	Brianna Farrell	University of North Carolina at Wilmington	Grace Marley	Health and Human Development
114: Seeing Water in Soil: Using Low-Field Nuclear Magnetic Resonance to Improve Geotechnical Characterization	Bryn Cribb	University of North Carolina at Charlotte	Ryan Rasanen	Engineering
115: Preserving Insulin Lispro Functionality Without Cold Storage Using Light-Assisted Drying	Jade Duerr	University of North Carolina at Charlotte	Susan Trammell	Physics and Astronomy
116: Using Antique Glass Plate Observations for Modern Astronomy	Jacob Crawford	University of North Carolina at Asheville	Britt Lundgren	Physics and Astronomy
117: Design and Field Evaluation of a Low-Cost Single-Axis Solar Tracker Using Photovoltaic Directional Sensing	Rohan Rajesh	North Carolina School of Science and Mathematics	Carlotta Berry	Engineering
118: Predicting Extremism: Social Media News Consumption and Authoritarian Personality Theory	Katelyn Kalkowski	North Carolina State University	Steven Greene	Political Science

119: Finding Joy in Physical Activity: A Qualitative Investigation of Positive Exercise Cognitions and Their Application to Physical Activity Enjoyment Among Underactive Adults	Meddows Creswell	University of North Carolina at Charlotte	Sara Levens	Psychology
120: Effects of Gallic Acid and Epigallocatechin Gallate on Cell Viability in DRD2-Deficient SH-SY5Y Cells	Xztashya Xztashya Porter	Fayetteville State University	Dr. Tomilowo Abijo	Biology
121: How does habitat structure mediate the relationship between anthropogenic noise and mammal species richness in an urban forest?	Sara Behnam	University of North Carolina at Charlotte	Dr. Sara Gagne	Environmental Science and Sustainability
122: Designing Trustworthy AI Recommendations for Engineers: Human-in-the-Loop Interfaces, Explainability, and Cognitive Bias	Ema Nova	University of North Carolina at Charlotte	Ilieva Ageenko	Computer Science
123: Targeting Therapy-Induced Senescence in Triple-Negative Breast Cancer Cells Using 5-Aminolevulinic Acid-Mediated Photodynamic Therapy	Pratima Ashok	North Carolina School of Science and Mathematics	Lee Graves	Biochemistry
124: Molecular and Cellular Consequences of OPRM1 Depletion in SH-SY5Y Neuronal Cells	Sade Peterson	Fayetteville State University	Tomilowo Abijo	Biology
125: Comparison of Dry Needle Placement Across Examiners with Varying Levels of Needling Experience: A Pilot Evaluation	Brianna Harvey	High Point University	Nathan Savage	Exercise Science and Nutrition
126: Developing an additivity-based method for estimating configurational entropy changes in proteins	Nicole Walker, Amanda Patneaude, Analise Lang	University of North Carolina at Pembroke	Benjamin Killian	Chemistry
127: Should Some Chemotherapeutics Be Taken	Sophia Harvey	University of North	Aadra Bhatt	Biology

with Food? Investigating the Role of Bile in Drug Absorption and Gastrointestinal Toxicity		Carolina at Chapel Hill		
128: Effect of Sweetpotato-to-Water Ratio on the Viscosity and Estimated Sweetness of a Sweetpotato-Based Milk Alternative	Darshan Santosh, Nitesh Manivannan, Oskar Krauss	Other/Not Listed	Brett Taubman	Chemistry
129: Measuring Proton Dose Using HDV2 Gafchromic Films	Amilia Price	East Carolina University	Regina DeWitt	Physics and Astronomy
130: Exploring Academic Self-Efficacy and Mentorship Participation Among Marginalized Students at HBCUs	jessica Montanez-Fuentes	Fayetteville State University	Michelle Bates	Social Work and Human Services
131: Reducing Organometallic Waste in PTQ-10 Synthesis Through Direct Arylation Polymerization	Reagan Williams	University of North Carolina at Asheville	Jeromy Rech	Chemistry
132: Losing Our Cool: Assessing Green Space Heat Mitigation and Public Health Vulnerability in North Carolina Urban and Suburban Counties	serah mobin, Melody Siam	Other/Not Listed	Anindita Das	Interdisciplinary Studies
133: The Difference in Reward Sensitivity in ADHD vs Neurotypical Individuals on a Dopaminergic Level	Bhavani Pruthvik Palpanoori	North Carolina School of Science and Mathematics	Norine Ho	Nursing and Public Health
134: Antimicrobial Activity in HVAC Exposed Soils	Kaden Wrasman	South Piedmont Community College	Chasity Moore	Biology
135: Evaluating Ecological and Economic Indicators of Durham Street Trees	Eileen Guo	North Carolina School of Science and Mathematics	James Clark	Environmental Science and Sustainability
136: Signaling Through Consumption: Understanding Brand and Product	Aditi Kaparthi	University of North Carolina at Charlotte	Mason Jenkins	Business

Attributions Among Gen Z Consumers				
137: Design of High Frequency Wireless Power Transfer for Drone Charging Application	Miguel Aviles	University of North Carolina at Charlotte	Ran Zhang	Engineering
138: Evaluating Eugenol as a HOG-1 Dependent Osmotic Stress Mimetic in Saccharomyces cerevisiae	Precious Khan Wondzi	Salem College	Dr. Jing Ye	Biochemistry
139: INVESTIGATING THE POTENTIAL OF 3-MA IN DECREASING PANCREATIC CANCER PROLIFERATION & CHEMORESISTANCE	Anusri Poreddy	University of North Carolina at Charlotte	Aneesha Dasgupta	Biology
140: Building an EV Battery Life Measurement System for Battery Repurposing	Aiden Sugg, Andrew Day	East Carolina University	Jason Yao	Engineering
141: A Sweet Kiss: Exploring the Bacterial Similarities of Couples Using Tongue Dorsum Saliva Samples	Breann Wusterbarth	Catawba College	Dr. Francisco Camacho	Biology
142: SALSA: SAST-Augmented LLM-Based Security Analysis	Rishi Nalam	University of North Carolina at Charlotte	Domenico Cotroneo	Computer Science
143: Social Media Engagement and Body Image in University Students	Eva Coles	North Carolina A&T State University	Michaeline Jensen	Psychology
144: Modulation of Heroin-Induced Dopamine Signaling by Ibogaine and Noribogaine in the Rat Nucleus Accumbens	Alexa Klein, Sierra Werner	High Point University	Scotty McIntosh	Chemistry
145: Examining Changes in Affective Attitudes Toward Physical Activity Following Episodic Future Thinking and Positive Affect Guided Imagery Interventions	Akhil Harish	University of North Carolina at Charlotte	Sarah Levens	Psychology
146: Multi-Organ Immune Effects of Combined PD-1	Srihithaa Vaidya, Aryan Pal	East Carolina University	Li V. Yang	Biology

and CTLA-4 Blockade in a Murine Melanoma Model				
147: Caring for Men Who Care: Moral Injury Levels in Men in Caring Professions	Eliza Harrell	University of North Carolina at Charlotte	Braveheart Gillani	Social Work and Human Services
148: Airflow and heat sink cooling for data centers	Danielle Panzo	East Carolina University	Pablo Nunez Hernandez	Engineering
149: Seeing Red: Media Portrayals and Identity Negotiation Among Naturally Redheaded Women	Laci Ram	Elon University	Karen Lindsey	Communications
150: The Relationship Between Activity State and Memory Performance in Older Adults With and Without Mild Cognitive Impairment	Suzanna Shafey	North Carolina State University	Shevaun Neupert	Psychology
151: Women in the Margins: A Case Study of Female Book Owners in the Rare Books Collection at Atkins Library	Sophie Mccollister	University of North Carolina at Charlotte	Randi Beem	History
152: The Effect of Limb-Specific Early Reperfusion on Hemodynamics	Patrick Claire	East Carolina University	Joseph Stock	Exercise Science and Nutrition
153: Fore-Edging: A Study of Decorative Techniques and the Book Cover	Pearl Burningham	South Piedmont Community College	Stephanie Stripling	Art History
154: Speaking for Species: The Power of Framing and Media Format in Shaping Anthropomorphism	Bronwyn Mulvaney, Jackson McCall	Elon University	Kim Epting	Psychology
155: Risk Avoidance in Digital Banking	Tina Nguyen, Charlie Marcantel	Queens University of Charlotte	Steven Cox	Business
156: "I think I can, I think I can": Daily Perceptions of Control Over Memory and Memory Failures	Julieta Pisa	North Carolina State University	Shevaun Neupert	Psychology
157: Blood Pressure Responses Across Repeated Voluntary Breath Holds in	Lakshanyaa Rajendran Balaji	East Carolina University	Joseph Stock	Health and Human Development

Older Adults with Elevated Blood pressure				
158: Development of an Advanced Filtration System for Nutrient Restoration and Optimization of Clean-in-Place Processes in the Dairy Industry	Dylan Walker	North Carolina A&T State University	Kristen Dellinger	Biology
159: The World at Your Feet: A Multimodal Assessment of Functional Balance	Jackson Cirami, Keira Chestnut	High Point University	Dr. Neil Petroff	Engineering
160: Dining on the Wing: Insect Diet Preference Among Big Brown Bats Across Ecoregions and Temporal Scales in North Carolina	Elias Gianopoulos	North Carolina State University	Michael Cove	Biology
161: Mitigating Musculoskeletal Fatigue in Interventionists: An Electromyography Analysis of the GLiFT Device	Alyssa Peruzzi, Megan Hall, Avigail Friedel, Shea Curran	University of North Carolina at Wilmington	Michel Heijnen	Exercise Science and Nutrition
162: Visualizing Public Health: Building Interactive Dashboards to Strengthen the North Carolina Public Health Workforce	Zoe Migioni, Nkazimulo Gumede	Johnson C. Smith University	Sabina Otienoburu	Nursing and Public Health
163: Breaking the Banking Barrier: Understanding What Drives Gen Z to Switch Banks	Daniella Ngongo, Alice Bianca Wettel, Evan Hart	Queens University of Charlotte	Steven Cox	Business
164: Predicting immunotherapy use in Lung Adenocarcinoma patients using genomic characteristics	Ishika Ravat	North Carolina School of Science and Mathematics	David Kane	Biochemistry
165: Examining Geographic Disparities in Diabetes Burden and Resource Access in Eastern North Carolina	Andrew Ormond	East Carolina University	Brandon Jones	Nursing and Public Health
166: Building Biorenewable Conjugated Polymers for Solar Panels from Lignin Waste Products	Helin Jaqcueline Herrera Urbina Grant	University of North Carolina at Asheville	Jeromy Rech	Chemistry

167: Investigating the Role of MUC1 in Cancer Cachexia	Kaustubh Tiwari	University of North Carolina at Charlotte	Aneesha Dasgupta	Biology
168: NFE2L2 Pathway Mutations Co-Occur with RAS Mutations and display codon bias in human tumors	Akhil Tumuluri	North Carolina School of Science and Mathematics	Bernard Weissman	Biology
169: Why are those leaves so red!?! Investigating Leaf Anthocyanin Synthesis Using Remote Sensing and Geospatial Analysis	Atticus Kenney, Jiaming Lu, Yao Li	University of North Carolina at Charlotte	Missy Eppes	Environmental Science and Sustainability
170: Optimizing the method to determine pharmaceutical potential of phytoplankton: exploring the effects of nutrient stress on phytoplankton metabolite production	Nina Le	University of North Carolina at Wilmington	Poulin X. Remington	Biochemistry
171: Evaluating the Effects of Shoreline Stabilization on Turbidity and Underwater Light Availability	Cadence Pendergrass	East Carolina University	Rachel Gittman	Biology
172: Sex Differences in Visual Attention and Filter Use: The Moderating Role of Pubertal Development	Lillian Wu	University of North Carolina at Chapel Hill	Anne Maheux	Psychology
173: Effects of Keratin on Heat Shock Recovery; Protective Properties of Keratin During Oxidative Stress in Human Embryonic Kidney Cells	Ahriyana Ramirez, Caleb Parsons	Western Carolina University	Heather Coan	Biology
174: Natives Land Act of 1913 Impact on Production and Spatial Geography of Pearl Millet in Post-Apartheid South Africa	Michelle Song	University of North Carolina at Charlotte	Stephanie Norander	Interdisciplinary Studies
175: Improving the Escalier Algorithm	Tevin Parathattal	University of North Carolina at Charlotte	Sebastien Bossu	Mathematics

176: Identifying Temperature-Dependent Regulation of Antibiotic Resistance in Enterococcus faecium as a Target for New Treatments.	Sandhya (Sana) Konar	Queens University of Charlotte	Dr. Rebecca Guth Metzler	Biochemistry
177: Study of the Photometry of quasar 3C 273	Elisa Zambrano Andrada	Western Carolina University	Enrique Gomez	Physics and Astronomy
178: Development and Evaluation of an LC–MS/MS Method for Controlled Drugs and Emerging Adulterants: Assessing Method Performance and Vial Surface Effects	Katherine Davis	University of North Carolina at Asheville	Saman Majeed	Chemistry
179: Muscle Architecture Throughout Growth Following Brachial Plexus Birth Injury	Bhavya Dhiman, Elle Robinson	North Carolina State University	Jacqueline Cole	Engineering
180: Analyzing the Relationship Between Soil Oomycetes and Fungal Community Makeup Following Fungicide Application in the Warren Wilson American Chestnut Orchard	Anathea Ball	Warren Wilson College	Eric Griffin	Biology
181: Mixed silane treatment of silicon wafers leads to different water contact angle measurements towards the preparation of conjugated polymer brush films	Alyssa Lovallo	High Point University	Pamela Lundin	Chemistry
182: Daily Stressors and Physical Symptoms: Chronic Conditions and Perceptions of Control Matter	Kirstin Gilbert	North Carolina State University	Shevaun Neupert	Psychology
183: Developing Synthetic Methods Towards Selectively Fluorinated Cage Compounds	Lucy Kidd	University of North Carolina at Charlotte	Markus Etzkorn	Chemistry
184: Effects of Inlet Pressure and Flow Straighteners on Microfluidic Flow Behavior	Anarghyan Raja	North Carolina School of	Christopher Thaxton	Physics and Astronomy

		Science and Mathematics		
185: Mutations of AtpI and subunit a of ATP synthase in Pseudomonas aeruginosa.	William Fairley	University of North Carolina at Asheville	Ryan Steed	Biochemistry
186: Computational Investigation of the Amyloidogenic Properties of Human Amylin within the C-terminal Domain through the Application of Multiple Proline Substitutions	Isabella Turner	Chowan University	Kyung-Hoon Lee	Biology
187: Effect of Particle Size on the Photocatalytic Degradation of Perfluorooctanoic Acid Using Brookite Phase Titanium Dioxide	Alondra Rubio-Gonzalez	University of North Carolina at Asheville	Oksana Love	Chemistry
188: The Benefits and Challenges of Providing Music Therapy in Community-Based Settings	Harlee Roberts	University of North Carolina at Charlotte	Vaughn Schmutz	Psychology
189: The Limitations of Extending Empathy	Ashley Robinson	University of North Carolina at Charlotte	Elizabeth Stearns	Sociology
190: From Pilot to Playbook: Expanding Premedical Student Supported Hypertension Outreach in Primary Care	Madeline Cox	University of North Carolina at Chapel Hill	Anjani Reddy	Health and Human Development
191: The Private Cost Paradox: Attention as a Negative Externality in Digital Capitalism	Moksha Agrawal	North Carolina School of Science and Mathematics	David Cantrell	Economics
192: Community-Engaged Development of the Preparedness Assessment for the Transition Home: A Reflexive Thematic Analysis of Focus Groups with Caregivers of Individuals with High-Grade Brain Tumors	Alaina Doss	University of North Carolina at Wilmington	Laurie Minns	Nursing and Public Health

193: Same City, Different Food Access: Comparing Distance, Operating Hours, and Venue Diversity at N.C. A&T and UNC-G	Kennedy McCormick, Ephraim Byers, Kyla Mahesa	North Carolina A&T State University	Shona Morgan	Environmental Science and Sustainability
194: Investigating Dietary Influence on T-Cell Response to ART in Acute HIV	Brielle Lee	North Carolina A&T State University	Julie Mannarino	Biology
195: Banking with Gen Z: How can Ally Bank connect with the next generation	Brynn Fogarty, Kiley Pappas	Queens University of Charlotte	Steven Cox	Business
196: Preservation and Restoration of Coral Reefs	Ilvika Ravat	North Carolina School of Science and Mathematics	Lauren Insko	Environmental Science and Sustainability
197: Modeling Moretti: Architectural Analysis of Mid-century Landmarks in Rome	Breonna Tuitt, Leo Rossi	University of North Carolina at Charlotte	Jeffrey Balmer	Architecture, Construction Management, and Interior Design
198: Teacher Training for Supporting Autistic Students in Inclusive Classrooms: From Evidence to Classroom Practice	Dhruv Aggarwal	Central Piedmont Community College	Tim'm West	Education
199: Recovery Language in Distressed Text: An Interpretable Measure That Transfers Across Corpora	Ivy Datta, Vajra Thota	South Piedmont Community College	Caitlin Cameron	Psychology
200: Assessment of PCB Accumulation in Catfish Muscle Tissue from Crabtree Creek, North Carolina	LaShae Brown, Elise Langer, Adam Harvey	William Peace University	Patrick Myer	Biology
201: Creativity AND Law: Exploring design thinking in legal problem- solving and communication	Maddy Tripp	University of North Carolina at Charlotte	Cindy Gilson	Law and Legal Studies
202: Using Data Science to Predict Microplastic Movement in Oceans	Nik Khot	University of North Carolina at Charlotte	Roger Tipton	Engineering

193: Same City, Different Food Access: Comparing Distance, Operating Hours, and Venue Diversity at N.C. A&T and UNC-G	Kennedy McCormick, Ephraim Byers, Kyla Mahesa	North Carolina A&T State University	Shona Morgan	Environmental Science and Sustainability
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legal problem- solving and communication		Carolina at Charlotte		
202: Using Data Science to Predict Microplastic Movement in Oceans	Nik Khot	University of North Carolina at Charlotte	Roger Tipton	Engineering

Session #3 Presentations

1:30 - 2:45 PM

Oral Presentations

Poster Presentations

	Title	Authors	Institution	Mentor	Discipline
CHHS122	Live Imaging Analysis of the role of Oligodendrocyte-specific TAK1 hyperactivation in Alzheimer's Disease	Jay Dakiwas	North Carolina State University	Jun Ninomiya-Tsuji	Biology
	Increasing the Functional Recovery and Cognitive Performance with Feverfew (Tanacetum parthenium) in the Drosophila melanogaster Familial Hemiplegic Migraine Type-2 Model	Tylyyn Flood	North Carolina School of Science and Mathematics	Jennifer Williams	Biology
	Dual-Stress Adaptive Evolution of Synechococcus elongatus UTEX 2973 Under Elevated CO? and Nickel for Bioremediation Applications	Eduardo Flores	North Carolina School of Science and Mathematics	Heather Mallory	Biology

	Title	Authors	Institution	Mentor	Discipline
CHHS 285	Exploring Honey-Derived Vesicle-Like Nanoparticles as a Delivery System for Hydrophobic Compounds in Zebrafish Embryos	Layla Ibrahim	North Carolina School of Science and Mathematics	Jennifer Williams	Biochemistry
	Discovery of Alpha Glucosidase Inhibitory Compounds from Spirodela polyrhiza (Giant Duckweed), Pistia Stratiotes (Water Lettuce), and Salvinia minima (Water Spangles) for Diabetic Treatment with Reduced Gastrointestinal Side Effects	Vihaan Kinra	North Carolina School of Science and Mathematics	Michael Bruno	Biochemistry
	Development of an Inexpensive Trehalose Quantification Assay for Characterizing Diet-Induced Hyperglycemia in a Drosophila melanogaster Model of Type 2 Diabetes	Ritika Mora	North Carolina School of Science and Mathematics	Tandy Grubbs	Biochemistry
	Design and Synthesis of a Small?Molecule Modulator of West Nile Virus NS1? Frameshift Pseudoknot to Enhance ?1 Programmed Ribosomal Frameshifting for Antiviral Intervention	Lucas Murdoch	North Carolina School of Science and Mathematics	Michael Bruno	Biochemistry

	Title	Authors	Institution	Mentor	Discipline
CHHS 289	The Orientalist Logic of US Policy Toward Iran	Siddhartha Bajpai	North Carolina School of Science and Mathematics	Tatiana McInnis	Political Science
	Machiavellianism in Modern Politics: How Self-Interest and Corruption is Reframed as Patriotism and Justice	Finley McLean	North Carolina School of Science and Mathematics	David Cantrell	Political Science
	Youth Climate Activism Shapes Local Environmental Policy and Community Engagement	Ritika Shah	North Carolina School of Science and Mathematics	David Cantrell	Political Science
	Electrification of the Rural South	Jude Stumpf	North Carolina School of Science and Mathematics	David Cantrell	Political Science

	Title	Authors	Institution	Mentor	Discipline
CHHS 294	Culture & Academic Self-Efficacy	Ennifer Moyei	University of North Carolina at Charlotte	Michael Matthews	Interdisciplinary Studies
	Video Games and Anime as Blueprints for Identity	Jeevan Nair	University of North Carolina at Charlotte	Dr. Balaka Basu	Interdisciplinary Studies
	Soul Food: The Origins, Impact, and Health Disparities Amongst African Americans	Wallace Love, Anaya Thomas	University of North Carolina at Charlotte	Colleen Hammelman	Psychology
	A Pilot Study: Exploring College Students' Perceptions of a Future Campus Garden's Role and Fruit Tree Initiative in Addressing Food Insecurity and Promoting Student Well-Being	Larensa Leak	Fayetteville State University	Dennis Corbin	Social Work and Human Services

	Title	Authors	Institution	Mentor	Discipline
CHHS 295	The Mortuary Traditions of the Lakota Sioux and the Wounded Knee Massacre	Carson Cusa	University of North Carolina at Charlotte	Sara Juengst	Anthropology and Archaeology
	MMF Thematic Anslysis	Mandy Williams	University of North Carolina at Charlotte	Sharon Watson	Anthropology and Archaeology
	Emotional Induction, Recognition Memory, and Anxiety Among Adults	Jasmine Snowden	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	The Influence of Snack Color on Snack Selection	Khiya Zahir	Elizabeth City State University	Kulwinder Kaur Walker	Psychology

	Title	Authors	Institution	Mentor	Discipline
Mebane 102	Robust Directional Sensitivity and Radiofrequency Susceptibility in Dipolarly Coupled Radical-Pair Compasses	Joanna Arul Jeeva	North Carolina School of Science and Mathematics	Michael Falvo	Physics and Astronomy
	Optimizing Multi-Detector Coincidence Thresholds for Pre-Supernova Neutrino Detection	Reneeka Roy	North Carolina School of Science and Mathematics	Joshua Queen	Engineering
	Design and Development of a Multi-Channel Ion Probe Sensing System for RDE Wave Characterization	Abhinav Karthikeyan	North Carolina School of Science and Mathematics	Eduardo Malvezzi Leite de Moraes	Engineering

	Title	Authors	Institution	Mentor	Discipline
Mebane 103	A Mathematical Approach to Prion Protein Misfolding	Morgan Cassell, Chris Cassell	Barton College	Ashley Bennett	Mathematics
	Using Markov Chains To Model Same-Aircraft Delay Propagation Across Scheduled Turnaround Times	Arnav Amar	East Carolina University	Dr. Susan Mattingly	Mathematics
	THE SUN AS A BUNSEN BURNER: MODELING FLUORESCENCE PROCESSES IN COMETARY COMAE	Nebiyu Nebiyelel ul	University of North Carolina at Charlotte	Qicheng zhang	Physics and Astronomy

	Title	Authors	Institution	Mentor	Discipline
Mebane 201	The Economic Impacts of Declining Birth Rates: A Literature Review	Cameron Browning	University of North Carolina at Charlotte	Melinda Adnot	Economics
	Small Firms and Artificial Intelligence: Adoption, Barriers, and Implementation	Agrata Awasthi	North Carolina School of Science and Mathematics	Meenu Tewari	Economics
	What Executives Don't Say: Predicting Guidance Cuts from Earnings Call Language	Yaz Hathiram	North Carolina School of Science and Mathematics	Rayn Sakaguchi	Economics
	Economic Freedom and Gender Inequality Across Brazilian Regions	Fernanda de Oliveira Sant'Ana	Western Carolina University	Edward Lopez	Economics

	Title	Authors	Institution	Mentor	Discipline
Mebane 202	Evaluating Prehospital Emergency Medical Services Involvement in Opioid Use Disorder Services: Use of Opioid Settlement Funds	Dhruv Buneti	North Carolina State University	Julianne Cyr	Nursing and Public Health
	Carbon Outgassing of Inland Appalachian Stream Habitats	Ivy Datta, Jessie Olan, Aryan Kumar,	South Piedmont Community College	Shea Tuberty	Environmental Science and Sustainability
	What Creative Ways Has The City of Charlotte Used To Support Urban Conservation	Naomi Kollman	University of North Carolina at Charlotte	Cindy Gilson	Environmental Science and Sustainability

	Title	Authors	Institution	Mentor	Discipline
Mebane 203	Amine-Functionalized MIL-101(Fe)/Activated Biochar Composite for Sustainable CO2 Capture	Matthew Cai	North Carolina School of Science and Mathematics	Tandy Grubbs	Chemistry
	Design and Synthesis of Novel Pyridone-Derived Unnatural Amino Acids for Gene Delivery	Athulya Sathya Narayanan, Kavya Rajaram	North Carolina School of Science and Mathematics	Bharathi Pandi	Chemistry
	Inducing PMOS-like symptoms in Drosophila melanogaster with polyethylene microplastics	Ziva Vargas	North Carolina School of Science and Mathematics	Jennifer Williams	Biology
	Reusable Carbon Quantum Dot-Based Solvent-Responsive Molecularly Imprinted Fluorescent Sensor Chip for the Detection of PFOA	Hannah Oh	North Carolina School of Science and Mathematics	Timothy Anglin	Chemistry

	Title	Authors	Institution	Mentor	Discipline
Mebane 165	NPFR1 Signaling in Alcohol-Driven Behavior in Drosophila melanogaster Toward Opioid-Independent AUD Pharmacotherapies	Ruhan Kothare	North Carolina School of Science and Mathematics	Heather Mallory	Biology
	Investigating BAPTA-Mediated Ca²? Inhibition Effects on Metformin-Dependent AMPK Rescue in Regeneration in Dugesia japonica	Mishka Mittal	North Carolina School of Science and Mathematics	Heather Mallory	Biology
	Magnesium-Doped Nickel Spinel Ferrite Nanoparticles as Lead(II) Adsorbents for Drinking Water Remediation	Kingston Lowman	North Carolina School of Science and Mathematics	Tandy Grubbs	Chemistry
	Functionalized copper phthalocyanine as a selective, non-noble metal catalyst for the electrochemical CO? reduction reaction	Nandana Marpadaga	North Carolina School of Science and Mathematics	Tim Anglin	Chemistry

	Title	Authors	Institution	Mentor	Discipline
Mebane 166	The Impact of Social Media Exposure on Attention and Performance Among College Students	Jasette Alexander	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	Group Size, Participation, and Problem Solving: A Pilot Study	Zaria Dunn, Jalen Delacruz Williams	Elizabeth City State University	Kulwinder Kaur-Walker	Psychology
	Neurodivergent Nurses: Navigating the New Graduate Experience	Juju Viray	Elon University	Lori Hubbard	Nursing and Public Health
	Evaluating the Physical and Nutritional Properties of Various Extruded Starch Snacks During In Vitro Oral Digestion	Mehr Kapoor	North Carolina School of Science and Mathematics	Deepti Salvi	Exercise Science and Nutrition

	Title	Authors	Institution	Mentor	Discipline
Mebane 168	Social Media Presence of Mid-Major Student Athletes: Building Trust and NIL Value	Skylar Cook, Izzy Del Bosco, Rylee Marchand, Sophie Willen	Elon University	Shaina Dabbs & Smaraki Mohanty	Communications
	Escapism for who? : an Analysis of Black Fan Art Discourse on X	Reggie Blue	University of North Carolina at Chapel Hill	E. Chebrolu	Communications
	Rethinking Food Access: Communication, Space, and Inequality in Food Assistance Systems in North Carolina.	Josie Perdue	University of North Carolina at Charlotte	Ian Binns	Communications
	Hollywood Intervention: Industry Coordinator- a Pre and Post Case Study	Jervis Albert	Winston-Salem State University	W. Russell Robinson	Communications

	Title	Authors	Institution	Mentor	Discipline
Mebane 169	Beyond the Taboo: Menstrual Equity on a Local and National Scale	Aliyah Acosta	Central Piedmont Community College	Dr. Deninne Pritchett	Gender, Ethnicity, Diversity, or Cultural Studies
	Why Can’t I See You? Coloristic Ideology Through Media in Mexican Culture	Melissa Hernandez Rojas	North Carolina School of Science and Mathematics	David Cantrell	Gender, Ethnicity, Diversity, or Cultural Studies
	History of Dreams: Defining, Authorizing, and Liberating Identity through Superstition and Science	Aanya Prashanth	North Carolina School of Science and Mathematics	David Cantrell	Gender, Ethnicity, Diversity, or Cultural Studies
	Heritage Language Maintenance and Cultural Preservation Among Second-Generation Indian Immigrants in the United States	Aditi Babar	University of North Carolina at Charlotte	Paloma Fernandez Sanchez	Gender, Ethnicity, Diversity, or Cultural Studies

Title	Authors	Institution	Mentor	Discipline
100: Ballots and Blood Pressure	Breonya Scott	North Carolina Central University	Drew Johnson	Nursing and Public Health
101: Understanding the molecular determinants for heat -induced Mpk1 kinase localization	Emma Light	University of North Carolina at Charlotte	Megan Mitchem, Andrew Truman	Biology
102: Beyond Seasonal Spikes: Assessing Geographic Ozone Vulnerability and Critical Care Outcomes in Youth Asthma Exacerbations	Alivia Smith	North Carolina A&T State University	Michael McCrory	Environmental Science and Sustainability
103: TCF1 Represses Pou2af1 (OCA-B) Expression in Jurkat T Cells: Implications for T Cell Gene Regulation	Cameron Mobley	North Carolina A&T State University	Dean Tantin	Biology
104: THE TUUNGANE PROJECT	Irene Kessy	University of North Carolina at Charlotte	Nicole Adams	Education
105: Impacts of Treatments on Cytoskeletal Structures of Equine Activated Fibroblasts	Addison Roper	North Carolina State University	Rosemary Bayless	Biology
106: Mindset and Adverse Childhood Experiences' Effect on Internal Success	Callie Branch	Meredith College	Mark O'Dekirk	Psychology
107: Design of a Mixed-Signal Circuit to Evaluate Audio Degradation from Conversion Limits and Amplifier Distortion	Sylvester Pudelko	University of North Carolina at Charlotte	Yawo Amengonu	Engineering

108: Invegstigating the Relationship Between Olfaction and Alzheimer's Disease	Mariam Raja	Gaston College	Hisayo Tokura-Gallo	Health and Human Development
109: Evaluation of Green-Synthesized Mushroom Silver Nanoparticles and Whole Genome Sequencing against Pathogenic Staphylococcus Resistance Genes	Josiah Dixon	Winston-Salem State University	Dr. Ewunkem Jude	Biology
110: Promoting Positive Child Peer Relationships Through Play with the Support of Teachers in Preschool Classrooms	Brook Ellyn Brown	Meredith College	Pamela Norcross	Education
111: Computational and Experimental Validation of a Dermal Mimicking Gelatin Phantom for Enhanced Thermal Imaging	Jessica Tejeda Rubalcava	University of North Carolina at Charlotte	Susan Trammell	Physics and Astronomy
112: Can Functional Foods Make Chemotherapy Safer? A Precision Microbiome Approach	Emilee Allen	University of North Carolina at Chapel Hill	Aadra Bhatt	Biology
113: Comparing Parents' Perceptions on Children's Learning Across Two Shared Reading Contexts	Bouchra Benzit	University of North Carolina at Chapel Hill	Kathryn Leech	Education

114: The Philosophy of Ubuntu: A Guiding Principle in Addressing Mental Healthcare Disparities in the Western Cape in Informal and Formal Settings.	Yazi Bulluck	University of North Carolina at Charlotte	Dr. Stephanie Norander	Psychology
115: Genomic and Phenotypic Characterization of Antimicrobial Resistance in Enterococcus from the Gut of Galleria mellonella	Ethan Rodriguez Chiappetta	North Carolina State University	Carlos Goller, Claire Gordy	Biology
116: Overcoming Cold-Chain Limitations: Thermally Stabilizing Inactivated Poliovirus Vaccine with Light-Assisted Drying	Edgar Gallardo-Ramirez	University of North Carolina at Charlotte	Susan Trammell	Physics and Astronomy
117: The Role of Bone Marrow Endothelial Cell-Derived Extracellular Vesicles in Gastrointestinal Regeneration after Radiation Injury	Evelyn Zhang	Duke University	Benny J. Chen	Biology
118: Mediterranean Mood: A Student Self-Study on Diet and Mental Health	Mariana Garcia Blanco, Carly Lopez, Jessie Chen, Ashley Stevens	South Piedmont Community College	Steph Stripling	Exercise Science and Nutrition
119: The Effects of Systemic Racism in Education on STEM	Mina Azhar	North Carolina State University	N/A	Education

120: Virulence Signatures and Biofilm-Forming Capacity of ESBL-Producing Escherichia coli in Wastewater and Agricultural Environments	Monica Sellars	Fayetteville State University	msellars2@broncos.uncfsu.edu	Biology
121: Secondary proton buildup in space radiation shielding	Marshall Malone	East Carolina University	Joel Dewitt	Physics and Astronomy
122: Plants vs. Plaques: Investigating Flavonoid Interference with Amyloid-Beta Aggregates in the Fight Against Alzheimer's Disease	Mac McConnell	Elon University	Kathy Matera	Chemistry
123: The Shrimp Effect: How color-concept associations update when objects change colors	Skylar Scobbo	High Point University	Melissa Schoenlein	Psychology
124: Investigating the Role of SKI in Enhancing CD8+ T cell Anti-Tumor Immunity	Lensa Osena	North Carolina School of Science and Mathematics	Yisong Wan	Biology
125: College Student Engagement and Perceptions of AI Use in the Classroom	Harper Melnick, Sofia Blodgett	High Point University	Kirsten Li-Barber	Psychology
126: Sociotechnical Interventions for Dementia Caregivers: Perspectives from Caregiving Manuals and Social Media	Sam Phillips, Calvin Zheng	University of North Carolina at Charlotte	Matin Yarmand	Computer Science

127: Evaluation of Dried Blood Spot Samples for Molecular Detection of Canine Vector-Borne Pathogens	Purvi Bhagat	Other/Not Listed	Barbara Qurollo	Biology
128: Food Literacy Measurement Review: Findings to Guide Tool Development for Population with Lower-Incomes	Samuel Baker	East Carolina University	Brandon Stroud	Nursing and Public Health
129: Leavering Photodegradation to Create a Method of Closed-loop Recycling for Conjugated Polymers	andrew allan	University of North Carolina at Asheville	Jeromy Rech	Chemistry
130: Mechanisms of Dicentric Chromosome Resolution	Parnavi Shukla	North Carolina School of Science and Mathematics	Kerry Bloom	Biology
131: Observing morphological development in GGB maize (Zea mays L.) leaf whorls using SEM	Nicole Villardi	Elizabeth City State University	Margaret Young	Biology
132: The Influence of Gen Z Preferences on Banking Choices: Strategies for Ally Bank	Madison Gallo, Megan Koslo, Madison Cantoni,	Queens University of Charlotte	Steven Cox	Business
133: Molecular Characterization of a Point Mutation on NHR25 Binding and Protein Expression	Francis. Boadu	Livingstone College	Dr.Debbie Thurtle-Schmidt	Biology
134: The “First 1000 Days”: Early Nutrition’s Role on Childhood Food Allergy Onset	Kae Saotome	North Carolina School of Science and Mathematics	Yuka Saotome	Health and Human Development

135: Enhancing Antioxidant Activity in Green Tea Through Natural Herbal Blends	Mehria Sherzad	Wake Technical Community College	Kumudu Peiris	Biochemistry
136: Dark Triad Traits by Religious Identity and Gender Among College Students	Brandon Labar, Gabrielle Hickey	Fayetteville State University	Sieun An	Psychology
137: Assessing the Antimicrobial Activity of Bacillus subtilis Containing Probiotic Skincare Treatment	Kaitlyn Woods, Crystal Pham, Lacy Natale,	Campbell University	Leila Reyes	Biology
138: Determine how the U2AF1 Q157P mutation alters the U2AF1-SETD2 interaction and chromatin-associated H3K36me3	Nishtha Vishwakarma	East Carolina University	Xiaomei He	Biochemistry
139: Examining the Dissemination of Sexual Health Education Across High Schools	Kelly Diep	East Carolina University	Sarah Maness	Nursing and Public Health
140: Association Between NeuroCom® Sensory Organization Test Performance and Functional Mobility Under Dual-Task and Gait-Constraint Conditions	Sarah Vaughn, Laney Newnam	University of North Carolina at Wilmington	Wayland Tseh	Exercise Science and Nutrition
141: Who's your pawpaw: genomic analysis of the parent to a hybrid Asimina species.	Ryan Bravo, Lore Jackson, Jay Bolin, Charles Horn	Catawba College	Francisco Camacho	Biology

142: Identifying Molecular Targets of Restless Legs Syndrome in Animal Models	Simran Takhar	East Carolina University	Stefan Clemens	Biology
143: Methods of Psychological Intervention in School Based Systems for Immigrant and Refugee Students	Salma El-Houshy	University of North Carolina at Charlotte	Diane Zablotsky	Psychology
144: Preserving the Moment of the Merger: A Queens Oral History Collection	Erin Naramore	Queens University of Charlotte	Andrea McCrary	English and Literature
145: Political Economy of Policing	Akshara Sisodiya	University of North Carolina at Charlotte	Martin Shuster	Philosophy, Ethics, and Religious Studies
146: Post-Immigration Dietary Change Across North and South Indian Regional Backgrounds Among Asian Indian Adults in North Carolina	Aryan Pal, Srihithaa Vaidya	East Carolina University	Satomi Imai	Nursing and Public Health
147: A Multi-State County-Level Analysis of the Impact of COVID-19 in the United States: Preparedness, Resource Allocation, and Disparate Outcomes	Sally Adenutsi	Livingstone College	Agbor Ebot	Nursing and Public Health
148: Transcriptional Changes in Human Bronchial Epithelial Cells Exposed to Various Combustion-derived Particulate Matter	Anish Ghosh	North Carolina School of Science and Mathematics	Ilona Jaspers	Biology

149: Euphemisms for Grief: The Inadequacy of Public Language for the Private Expression and Experiences of Loss	Andrea George	North Carolina School of Science and Mathematics	David Cantrell	Gender, Ethnicity, Diversity, or Cultural Studies
150: The Ability of Sown Wheat Seeds to Germinate After Spectrum of Soil Treatments with Thymol-Derived Nanoemulsion Particles	Shaindellie Clemons	Chowan University	Torrence gill	Environmental Science and Sustainability
151: Modeling and Validating Carbon Resource Competition in Synthetic Microbial Communities	Gabriela Ortiz	North Carolina State University	Chris Dundas	Biology
152: Insights into the Hormonal Regulation of Promoter Elements the ichnoviriform Associated with Campoletis sonorensis has which Ensures Successful Parasitism of Endoparasitoid Host.	Kayla Parker	Chowan University	Torrence Gill	Biochemistry
153: Quantifying the Association of Individual and Neighborhood ITN Use with Malaria Among Children Under Five in Ghana and Nigeria: A DHS-VII and DHS-VIII Analysis	Hannah Larbi, Mercy Agbai	Meredith College	Carolina Perez-Heydrich	Nursing and Public Health

154: Joy, Art, and Community: How Drag Impacts Mental Health Among Its Performers	Lay Guy	University of North Carolina at Charlotte	Travis Scheadler	Social Work and Human Services
155: Food Allergies and Their Effects on Grocery Price Disparities and Purchasing Patterns	Connor Kresock	High Point University	Rivin Perinchery	Economics
156: Phenotypic and molecular characterization of six geminiviruses infecting tomato lanai.	Sela Bettoli, Sophie Anikow	North Carolina State University	Trino Ascencio-Ibáñez	Biochemistry
157: Gamifying Academic Progression: A Course Architecture for Mastery, Agency, and Rigorous Online Discussion	Shunsuke Seki	Western Carolina University	Christopher Doval	Education
158: The Impact of Which Creativity has Shaped Civil Engineering and Improved the City of Charlotte	Daniel Chacon Mora	University of North Carolina at Charlotte	Dr. Cindy Gilson	Environmental Science and Sustainability
159: Space Fashion: Developing Protocol and Detailed Analysis for The Next Generation Spacesuit Fabric Durability Against Lunar Highlands Dust Simulant	Enijah Linville, Cameron Roberts, Atef Aboukhozaim,	Forsyth Technical Community College	Dr.Tandeka Boko	Engineering
160: The Political Behavior of Recreation Areas: Political Participation in Wrightsville Beach	raegan pickard	University of North Carolina at Wilmington	Stephen Meinhold	Political Science

161: Triphala-Derived PLGA Nanoparticles as a Non-Surgical Intervention Against Crystallin Aggregation in Age-Related Cataracts	Subailakkiya Santhakumar	North Carolina School of Science and Mathematics	Santhakumar Rajendran	Biochemistry
162: Freight Safety Corridors in Charlotte: A Corridor-Based Assessment of Truck-Involved Crash Risk and Severity	Cooper Oates	University of North Carolina at Charlotte	Carlos Gonzalez-Calderon	Engineering
163: Ally Gen Z Study	Evan Hart, Alice Bianca Wettel, Daniella Ngongo,	Queens University of Charlotte	Steven Cox	Business
164: Cell Response to Biomaterial Coatings During Nutrient Deprivation	Jordan Wilcox	Western Carolina University	Heather Coan	Biology
165: Optimizing Porcine Granulocyte Isolation to Evaluate Inflammatory Injury in Ex Vivo Intestinal Machine Perfusion	Anay Hapani	North Carolina School of Science and Mathematics	Caroline McKinney-Aguirre	Biology
166: Development of a Portable Gas Chromatography Platform for Human Breath Analysis	Srideekshitha Sureshkumar	East Carolina University	Vladimir Dobrokhotov	Interdisciplinary Studies
167: Avian Activity and Native Bird Species Appearance Across an Urban Canopy Cover Gradient	Drayton Severns	Gaston College	Marguerite Bishop	Biology

168: Effects of Hydrogen Peroxide-Induced Oxidative Stress and Keratin Treatment on Cellular Recycling Pathways in HEK293 Cells	Kaitlyn Tahquette	Western Carolina University	Dr. Heather B. Coan	Biology
169: K-pop Fandom: Associations with mental health, body image, and identity.	Emma Karwoski	Queens University of Charlotte	Tommy DeRossett	Psychology
170: Investigating the Relationship Between Molecular Properties, Blood-Brain Barrier Permeability, and ADHD Medication Effectiveness	Immerya Barr	Queens University of Charlotte	Rebecca Guth-Metzler	Chemistry
171: A novel SCA-linked CHIP mutation fails to suppress polyglutamine aggregation in a cellular model	Nina Levret de Melo	University of North Carolina at Chapel Hill	Jonathan Schisler	Biology
172: Transferable Hotspot Ranking and a Universal Concentration Distribution for Microplastics in Freshwater Lake Sediments	Saicharan Mudium	North Carolina School of Science and Mathematics	Daniel Egger	Environmental Science and Sustainability
173: Opioid Use Disorder Strategy Implementation Among North Carolina EMS Systems: A Quality Improvement Framework Analysis	Jack Kelley	University of North Carolina at Chapel Hill	Julianne Cyr	Nursing and Public Health

174: Visualizing the Biochemistry of Cell Division Using Fluorescent Cyclins in Living Yeast Cells	Lucas Liu	North Carolina School of Science and Mathematics	Orlando Arguello-Miranda	Biology
175: From Road to Rest: The Role of Transition Time in Recovery	Carter Pape	Elon University	Erika Lopina	Psychology
176: Changes in Intermuscular Coherence Between Plantar Intrinsic and Plantarflexor Muscles During Prolonged Walking	Snehal Swain	North Carolina School of Science and Mathematics	Jason Franz	Biology
177: Ally Financial Study	Charles Marcantel, Tina Nguyen	Queens University of Charlotte	Steven Cox	Business
178: Investigation on the Genetic Causes of Rapid Endogenous Retrovirus Expansion in CC015 Collaborative Cross Mice	Julian Steck	North Carolina School of Science and Mathematics	Fernando Pardo Manuel de Villena	Biology
179: Satellite-Based Mapping of Hurricane Florence Flooding and Building Exposure Along the Cape Fear River in North Carolina	Nam Tran	Guilford College	Trung Tran	Geography/Geology
180: Investigating Edge AI Applications to Support Informed Construction Jobsite Decision-Making	Austin Mangold	University of North Carolina at Charlotte	Gongfan Chen	Engineering
181: Comparing Effects of Mutations in p53, the Guardian of the Genome	Pari Rohilla, Sean Heurtin	University of North Carolina at Charlotte	Ellen Wisner	Biology

182: Creativity and Art Expression in Charlotte	Eduardo Soto	University of North Carolina at Charlotte	Cindy GIlson	Art History
183: Examining Biofilm Formation of Prevalent Nitrate Reducing Oral Biofilm Bacteria Neisseria mucosa	Clahra Buswell	Campbell University	Michelle Suhan Thomas	Biology
184: Amplification of 16S via PCR in Two Dragonfly Species	Colleen Reynolds	University of North Carolina at Charlotte	Sandra Clinton	Environmental Science and Sustainability
185: Eastern Bluebirds nesting preference patterns	Hollyn Dunn	Queens University of Charlotte	Jeff Thomas	Biology
186: Electrode Design and Mechanical Deformation Effects in Laser-Induced Graphene Electric Double-Layer Supercapacitors	Rishika Subudhi	North Carolina School of Science and Mathematics	Dr. Falvo	Physics and Astronomy
187: Localized White-matter Tractography and Structural Integrity Correlations with Physiological/ Psychological Stress	Aiden Balandan	University of North Carolina at Chapel Hill	Rosie Dutt	Biology
188: Seniority and Stability: Examining Legislative Agenda Patterns in Congress	Ava Jessup	University of North Carolina at Charlotte	Eric Heberlig	Political Science
189: Relationship between Tooth Replacement Rate and Tooth Size in Cichlid Fishes	Laura Grossheim	University of North Carolina at Wilmington	Pierre Le Pabic	Biology
190: Modeling Tourism-Related Pollution Transport in the Preguicas River, Maranhao, Brazil	Jonah Dickerson	East Carolina University	Andrea Presotto	Geography/Geology

191: Development of the Brain Cancer Care Team Caregiver Information Sheet for Patients and their Caregivers: A Community Engaged Approach	Alyssa Granados-Wheeler	University of North Carolina at Wilmington	Laurie Minns	Nursing and Public Health
192: Student mental well being at JCSU	Farah Elshahat, travis dixon	Johnson C. Smith University	Cooper douglas	Health and Human Development
193: In Silico Evaluation of Amyloidogenic Features in Neurodegeneration-Associated Prion Proteins	Anna Holcombe	Chowan University	Kyung-Hoon Lee	Biochemistry
194: Computational Analysis of Stress Hormone Binding to Stress-Related Target Proteins	Brigitte Kittner	Queens University of Charlotte	Rebecca Guth-Metzler	Biochemistry
195: Understanding the associations between future-oriented thinking, personality, and types of exercise motivation in underactive individuals to inform physical activity promotion	Anamarie Oprea	University of North Carolina at Charlotte	Sara Levens	Psychology
196: Magneto-Mechanical Actuation as an Alternative Approach to Treating Glioblastoma	Ramiro Trejo	East Carolina University	Juan Beltran-Huarac	Physics and Astronomy
197: Efficacy of RNA thermometers in combating deadly pathogenic fungi	Rowen Watson	Queens University of Charlotte	Rebecca Guth-Metzler	Biochemistry

198: Benchmarking Vision- Language Models for Augmented Reality Content Realism	Tanish Pentakota	North Carolina School of Science and Mathematics	Elias Rotondo	Computer Science
199: Composition of aquatic macroinvertebrate populations as indices of water quality on small retention ponds in Anson and Union County, North Carolina	Momo Kong, Anna Hernandez, Mac Looney,	South Piedmont Community College	Chasity Moore	Biology
200: Patterns of Moth Species Richness across a Latitudinal Diversity Gradient	Willow McCammon	Montreat College	Joshua Holbrook	Environmental Science and Sustainability
201: UGV Localization using LeGO-LOAM with ICP Refinement for Path Traversal	Hariom Pughat	University of North Carolina at Charlotte	Srinivas Akella	Computer Science
202: Barriers to Utilizing Mental Health Resources Among Minority Undergraduate Students	Neya Rajkumar	University of North Carolina at Charlotte	Tyisha Terry	Nursing and Public Health

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Session #4 Presentations

2:45 - 4:00 PM

Oral Presentations

Poster Presentations

	Title	Authors	Institution	Mentor	Discipline
CHHS122	Mathematical Measures for Gerrymandering: An Introduction to Ensemble Analysis with Markov Chain Monte Carlo	Yoojin Lim, Saad Malik, Alexander Reynolds, Violet Schnabel	Central Piedmont Community College	Mick Stukes	Mathematics
	Optimizing Simulation Settings in Quantum Computing	Rukmini Roychoudhury	North Carolina School of Science and Mathematics	Berndt Mueller	Computer Science
	Same Task, Different Author: Comparing Human and AI Code Security	Emmanuel Onamade	University of North Carolina at Charlotte	Domenico Cotroneo	Computer Science
	How Labor Practices in the Gaming and Animation Industries Contribute to Worker Burnout and Exploitation	Tyler Wu	University of North Carolina at Charlotte	Matt Thayer	Computer Science

	Title	Authors	Institution	Mentor	Discipline
CHHS 289	Molecular Modeling Approaches to Identify Novel Natural Compound Beta-Glucuronidase Inhibitors	Ankit Singh	University of North Carolina at Chapel Hill	Aadra Bhatt	Biochemistry
	Creation of a Novel MerTK Small-Molecule Inhibitor for Use in Ewing Sarcoma Cancer Therapy	Sebastian Sharp-Blancarte	North Carolina School of Science and Mathematics	Tim Anglin	Biochemistry
	From Enzyme to Field: A Multi-Modal Approach to Combating Fusarium oxysporum Through Cdc14 Inhibition, Nanoparticle Delivery, and AI-Based Detection	Brendan Li, Andrew Hu	Other/Not Listed	Latha Shankar	Biochemistry
	A Self-Optimizing AI Agent for Rapid Assay Method Transfer to a Closed Platform Liquid Handling Robot	Aadil Khan	North Carolina State University	Marnon Gracieux	Biochemistry

	Title	Authors	Institution	Mentor	Discipline
CHHS 294	State and Federal Education Policies Affecting Immigrant Inclusion in Charlotte's Early Childhood Education Workforce	Sonika Pattila	University of North Carolina at Charlotte	Stephanie Potochnick	Social Work and Human Services
	The Feelings of Food Security: A Comparison of Self-view Between Food-insecure and Non-food-insecure Populations	Emily Parris	William Peace University	Jen Blush	Social Work and Human Services
	Computational Sentiment Analysis of Internal Union Reform Communications: Mapping Ideological Fragmentation within the UAWD Caucus	Leviticus Lintag	Fayetteville State University	Abraham Walker	Sociology
	Disposable Bodies: Homelessness and Necropolitics in Modern Capitalism	Chigozie Obi	North Carolina School of Science and Mathematics	Tatiana Mcinnis	Sociology

	Title	Authors	Institution	Mentor	Discipline
CHHS 295	The Patterns of M-Avoiding Integers	Drew Sica	North Carolina School of Science and Mathematics	Reed Hubbard	Mathematics
	Brocard Angle Invariance Under Equal Side Division	Matthew Kang, Levi Husar, Drew Sica,	North Carolina School of Science and Mathematics	Reed Hubbard	Mathematics
	Same Dynamics, Different Structures in Energy-Preserving Operator Fits	Pranava Kumar	North Carolina School of Science and Mathematics	Manolis Kellis	Mathematics
	Maximizing Graph Order with Fixed Matching Number	Ann Louthan, Kevin Luo, Amelia Wagner,	North Carolina School of Science and Mathematics	Reed Hubbard	Mathematics

	Title	Authors	Institution	Mentor	Discipline
Mebane 102	Associations Between Tree Fecundity and Wildlife Distribution	Emily Tang	North Carolina School of Science and Mathematics	James Clark	Environmental Science and Sustainability
	Synthesis of a Thiolated MOF/Graphene Oxide Hybrid for Enhanced Water Stability and Selective Removal of Heavy Metals	Fangjun Xu	North Carolina School of Science and Mathematics	Michael Bruno	Environmental Science and Sustainability
	Greenhouse Production and Management of Poinsettias.	Bryson Helton	North Carolina State University	Diane Mays	Environmental Science and Sustainability
	Impacts of Japanese Knotweed on Nitrate Dynamics and River Continuum Patterns in Appalachian Mountain Streams	Emily Hurst, Robert Fieldsend, Sarah Chambers,	Other/Not Listed	Shea Tuberty	Environmental Science and Sustainability

	Title	Authors	Institution	Mentor	Discipline
Mebane 103	Prebiotic Formation Kinetics of ?,??, and ?? Amino Acids from Aminonitriles in Titan Conditions	Violet Bradshaw	North Carolina School of Science and Mathematics	Michael Bruno	Physics and Astronomy
	Quantum-Accelerated Steiner-Tree Optimization for Real-Time Disaster Relief Operations	Spencer Joyce	North Carolina School of Science and Mathematics	Bill Yang	Physics and Astronomy
	Analysis of a Microwave Plasma on the Basis of Varied EMF Wave Interactions	Nikhil Mehta	North Carolina School of Science and Mathematics	Michael Falvo	Physics and Astronomy
	Developing User-Focused Data Tools for the Next-Generation Skynet Robotic Telescope Network	Bradley Warren	University of North Carolina at Chapel Hill	Daniel Reichart	Physics and Astronomy

	Title	Authors	Institution	Mentor	Discipline
Mebane 201	Prediction vs Explanation in Economics	Ryan DeFalco	High Point University	Brandon Dragone	Economics
	The Geographic Lottery & Global Inequality	Opemipo Isijola	University of North Carolina at Charlotte	Theresa Mannah-Blankson	Economics
	How Food Inflation Affects Human Health and Mental Health	Zione Oliver	University of North Carolina at Charlotte	Theresa Mannah-Blankson/Apryl Alexander	Economics
	Temperature and Volatility in Phase IV EU ETS Carbon Market	Jeevith Reddy, Vivaan Mandha, Harshitha Rengadurai,	North Carolina School of Science and Mathematics	Anindita Das	Economics

	Title	Authors	Institution	Mentor	Discipline
Mebane 202	Olfactory Function For Everyone: Engineering an Accessible Approach to Olfactory Sensory Neuron Recovery	Riya Anumakonda, Abigail Gray, Shaivi Shriyan,	North Carolina School of Science and Mathematics	Keegan Storrs	Engineering
	How has the Light rail innovated creatively public transportation in Charlotte?	Bryce Mcpherson	University of North Carolina at Charlotte	Dr. Cindy Gilson	Engineering
	Predicting Autistic Meltdowns from Wearable Biosensor Data: A Subject-Wise Comparison of Feature-Based and Deep Learning Models	Dhruv Aggarwal	Central Piedmont Community College	Tim'm West	Computer Science
	Predicting User Departure from Hate Communities: A Multi-dimensional Analysis of Reply Features	Patience Ventura	Central Piedmont Community College	Keith Burghardt	Computer Science

	Title	Authors	Institution	Mentor	Discipline
Mebane 203	Green Synthesis of Folic Acid-Functionalized TiO2-Bi2O3 Nanohybrids as a Sonosensitizer for Enhanced ROS Production in Sonodynamic Therapy	Vivien Lin	North Carolina School of Science and Mathematics	Timothy Anglin	Chemistry
	Bartonella and Leishmania Detection within Sandflies	Bridget Appiah	North Carolina State University	Ricardo Maggi	Biology
	Exploration into Mechanisms Behind Protein Translocation in Lymphocyte Apoptosis	Max Wei	North Carolina School of Science and Mathematics	Priyamvada Acharya	Biochemistry
	Understanding the Obesity Epidemic Utilizing the Biopsychosocial Model	Harlee Roberts	University of North Carolina at Charlotte	Tracy Bonoffski	Psychology

	Title	Authors	Institution	Mentor	Discipline
Mebane 165	Effects of Sphingosine-1-Phosphate on Osteoblast Differentiation in a Stroke-Mimicking Microenvironment	Catherine Malacane	North Carolina State University	Jacqueline Cole	Engineering
	Experimental Noise Mitigation in Offset Tandem Rotors Using NACA 2415 Toroidal Propellers	Abhinav Das	University of North Carolina at Charlotte	Arun Babu	Engineering
	Determining the Rolling Resistance Coefficient of the Spherical Sailing Omnidirectional Rover (SSailOR) Prototype via Image Processing Integrated with Rolling Dynamics	Heidi Mcneill	North Carolina School of Science and Mathematics	Aditya Varanwal	Engineering
	Seeing the Invisible Flame: UV Sensing for Hydrogen Flame Detection in Wind Tunnels	Shrihari Murali	North Carolina School of Science and Mathematics	Eduardo Leite de Moraes	Engineering

	Title	Authors	Institution	Mentor	Discipline
Mebane 166	ECOSORT: Automated Waste Sorter	Darwin Iglesias, Fedor Fedorov, Bless Langmia , Carol Batidzirai	Central Piedmont Community College	Heather Song	Environmental Science and Sustainability
	A Statistical Assessment of Hydropower's Role in Sustainable AI Data Centers	Hashini Karthik	Guilford College	Anindita Das	Environmental Science and Sustainability
	A Systematic Review of Nickel Doping and Dye-Sensitization on TiO2 for Sacrificial Agent Free Hydrogen Evolution	Pihoo Agarwal	North Carolina School of Science and Mathematics	Michael Bruno	Environmental Science and Sustainability
	Past and Future Century-Scale Projections of Shoreline Evolution Along the Carolina Coast	Aubrey Brostedt	North Carolina School of Science and Mathematics	Brad Murray	Geography/Geology

	Title	Authors	Institution	Mentor	Discipline
Mebane 168	Evolution of Surgical Treatment for Slipping Rib Syndrome: From Cartilage Excision to Structural Stabilization	Leah Cavallaro	North Carolina School of Science and Mathematics	David Cantrell	Health and Human Development
	Accelerating Ischemia Reperfusion Injury Drug Discovery Through Polypharmacology-Based Multi-Target Screening	Aditi Senthil Prasad	North Carolina School of Science and Mathematics	Suguna Devi Sakkiah	Health and Human Development
	Genotyping of Preclinical Mouse Models for the Experimentation of Chronic Primary Pain Conditions	Sreya Sudarshan	North Carolina School of Science and Mathematics	Andrea Nackley	Health and Human Development
	Surrender, Purpose, and Sobriety - A Comparative Review of Faith-Based and Secular Substance Use Disorder Recovery	Makayla Myers	University of North Carolina at Charlotte	Ian Binns	Health and Human Development

	Title	Authors	Institution	Mentor	Discipline
Mebane 169	Racial Representation in Student Government : A Longitudinal Analysis of High School Yearbooks, 2000-2010	Nandhana Ramesh	North Carolina School of Science and Mathematics	Thurston Domina	Education
	College Students with Autism: Academic Challenges and Support Systems	Alaija Alexander	University of North Carolina at Charlotte	Leslie Bross	Education
	Active Learning Approaches in Undergraduate Chemistry and Their Effects on Student Learning and Motivation	Yasmina Heritch	University of North Carolina at Charlotte	Kimberly Buch	Education

Title	Authors	Institution	Mentor	Discipline
100: Assessment of Demolition-Related PM2.5 Exposure and Chemical Composition in an Environmental Justice Community	Donovan Banks	North Carolina Central University	Richmond Bryant	Environmental Science and Sustainability
101: NOVA: An Edge AI Autonomous Robotic Assistant for Intelligent Construction-Site Inspection	Shreem Dixit	University of North Carolina at Charlotte	Gongfan Chen	Computer Science
102: Differences in Veteran vs. Civilian Bodily Response to Solfeggio Frequencies	Skylar Bledsoe	Johnson C. Smith University	Tennille D. Presley	Biology
103: Upcycling Contaminated Waste: Co-Pyrolysis of Agricultural Plastic Mulch and Crop Residues	Maya Hardison, Joshua Hester	North Carolina State University	Hui Li	Environmental Science and Sustainability
104: Multilingual Students in Monolingual Classrooms: Observations from Service Learning in Belize	Madison Talton	North Carolina A&T State University	Deana McQuitty	Physical/Occupational Therapy and Speech Language Pathology
105: Targeting Immune Pathways to Enhance the Oncolytic Potential of Reovirus Against Fibrosarcoma	Alexander Roberts	Elon University	Efrain Rivera-Serrano	Biology
106: The Impact of Switzerland's High-Deductible Insurance Model on Access to Primary Preventative Services	Braelyn Howard	Wake Forest University	Stephanie Bunch	Nursing and Public Health
107: Tracking Athlete Progression: A Data-Driven Approach to Evaluating NCAA Track & Field Programs	Brianna Malone, Demitrio Lukaitis	High Point University	Jakub Michel	Mathematics

108: Understanding seismic activity in the Appalachians of North Carolina	Sierra Lawson	North Carolina A&T State University	Dr. Zhigang Peng	Physics and Astronomy
109: Violacein: Evaluating the Antimicrobial Activity of Chromobacterium violaceum and Janthinobacterium lividum Against Gram-Positive and Gram-Negative Bacteria	Muntahin Hasan Maisha	Meredith College	Susan Gardner	Biology
110: How do professors teach undergraduate biostatistics? An exploratory study	Leila Zwetsloot, Jennifer Zwetsloot, Martie Thompson, Christopher Seitz	University of North Carolina at Chapel Hill	Christopher Seitz	Nursing and Public Health
111: Childhood Abuse and Obesity: Testing Gene-Environment Interactions	Sneha Galla	North Carolina State University	Aura Mishra	Biology
112: Invisible Caregivers: Financial Policy Gaps Affecting Grandmother-Led Kinship Care in the United States	Anastasia Sellars-Thompson	Fayetteville State University	Tamara Woods	Social Work and Human Services
113: Insufficiencies of the Boids Model in Describing Starling Separation Events	Will Swinford	North Carolina School of Science and Mathematics	Tyson Hedrick	Biology
114: Microwave Spectrum and Analysis of 2,4,6-Trifluorophenol	Tabitha Holden, Samantha McCullough, Sebastian Thompson-Vazquez	Other/Not Listed	Gordon Brown	Chemistry
115: Fold, Create, Connect: Zines as Arts-Based Health Communication	Thuan Nguyen	University of North Carolina at Charlotte	Margaret Quinlan	Communications

116: Development and Characterization of a Prototype Regolith-Driven Rotational Triboelectric Nanogenerator System for Lunar Surface Applications	Blanca Rovira Salvador, Tyler Welch	High Point University	Eve Klopf	Engineering
117: How Does the Chesapeake Bay Influence Supercell Thunderstorm Evolution and Hazard Production?	Matthew Chew, Roger Riggin	University of North Carolina at Charlotte	Casey Davenport	Environmental Science and Sustainability
118: Evaluation of Data Correction Methods in Determining Period-Luminosity Relations Across Pulsating Variable-Star Classes from GAIA DR3	Nathan Li	North Carolina School of Science and Mathematics	Judit Ries	Physics and Astronomy
119: Building Targeted Degraders & Inhibitors for the DNAJ-PKAc Fusion Protein in Fibrolamellar Carcinoma	Sheba Gage	University of North Carolina at Chapel Hill	David Drewry	Chemistry
120: Least but not Last: The Influence of a Naturalistic Environment across Least Killifish Lifestages	Sydney Paust	University of North Carolina at Asheville	Rebecca Hale	Biology
121: Light-Assisted Drying for Cold-Chain-Free Pandemic Flu Vaccine	Griffin Moyers	University of North Carolina at Charlotte	Susan Trammell	Physics and Astronomy
122: Measuring the Diameter of Lemur Hair	Andrew Green	North Carolina State University	Lisa Paciulli	Biology
123: Envisioning a violence-free community through Community-Based Zine making	Rain Drennan	University of North Carolina at Charlotte	Jessamyn Moxie	Nursing and Public Health
124: Exploring Biorenewable Chlorinated Derivatives of PTQ-10 for Organic Solar Cells	Matt Lindsey	University of North Carolina at Asheville	Jeromy Rech	Chemistry

125: Bridging Cell Fate Reprogramming: Precision Bipolar Waveforms to Restore DNA mobility in the Tumor Microenvironment	Aditi Gadde	North Carolina School of Science and Mathematics	Mike Sano	Biology
126: Fruiting Fungal Diversity Comparison Pre and Post Severe Disturbance–Hurricane Helene and Soil DNA Metabarcoding	Illiana Walsingham-Johnson	University of North Carolina at Asheville	Jonathan Horton	Biology
127: Artificial Intelligence Powered Autonomous and Distributed Multi-Drone Platform	Madison Hasley	University of North Carolina at Charlotte	Dr. Ran Zhang	Engineering
128: The Role of Host Genotype in the Survival of Nematostella vectensis	Amritha Selvaraj	University of North Carolina at Charlotte	Adam Reitzel	Biology
129: An Assessment of Workplace Policies and Support on Breastfeeding Among Employed Mothers	Chandler Johnson	University of North Carolina at Charlotte	Jessica Escobar DeMarco	Health and Human Development
130: Tracing Origins of Organismal Pollution in Marsh Creek	Abbey Carruthers	North Carolina State University	Angela Allen	Environmental Science and Sustainability
131: Reframing or Letting Go? Comparing Cognitive and Mindfulness Strategies for Self-Criticism on Heart Rate Variability	Jadyn Kuenzel	High Point University	Laura Nagy	Psychology
132: Historical and Intergenerational Trauma in Healthcare Experiences of South Asian Migrants	Saran Jolly	University of North Carolina at Charlotte	Erik Byker	Nursing and Public Health
133: Site-specific protein constructs to interrogate posttranslational modifications on copper metallochaperone proteins	Charlie Stogner	University of North Carolina at Charlotte	Eva Ge	Biochemistry

134: AI Chatbots and Self-Criticism: Comparing the Impact of Human vs. Artificial Feedback	Sawyer Harrold	High Point University	Laura Nagy	Psychology
135: Title: Navigating GLP-1 Conversations: Social Media Perspectives on Postpartum Health	Anusri Poreddy	University of North Carolina at Charlotte	Margaret M. Quinlan	Communications
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137: Are there any minerals of economic or scientific significance in sedimentary rock from the Sandhills region of North Carolina?	Martha Robbins	Wake Technical Community College	Gretchen Miller	Geography/Geology
138: Physics Guided Deep Learning for Indoor Airborne Contaminant Prediction Using Digital Twin Simulations	Smit Patel	University of North Carolina at Charlotte	Dr. Yao Li	Environmental Science and Sustainability
139: How Differing Theories of the 1985 Enrique Camarena Murder Reshaped U.S.-Mexico Diplomacy	Amy Husar	University of North Carolina at Charlotte	Jurgen Buchenau	History
140: Exploring Intentionality in Technology Interactions through Anti-Converged Media Device Packaging Solutions	Vedish Thimma	North Carolina State University	Steven Miller	Engineering
141: Evaluating the quality and abundance of coarse woody debris in a forested NC ecosystem after a prescribed fire	Vishwa Trivedi, Dhvani Joshi, Lexi Randall	North Carolina State University	Zakiya Leggett	Environmental Science and Sustainability

142: Development and Optimization of a Topical Botanical Oil Incorporating Chelidonium majus and Juglans nigra for Podiatric Antifungal Applications	May Mabrouk	University of North Carolina at Charlotte	Margaret Kocherga	Biology
143: Social Justice in the Judiciary System: Evaluating Psychological and Mental Wellness of Targeted Populations	Titas Mukherjee	University of North Carolina at Charlotte	Diane Zablotsky	Psychology
144: Stereoselective Modulation of the Autophagy-Lysosomal Pathway in Human Neuroblastoma Cells	Mel Negrao Azin	University of North Carolina at Chapel Hill	Jonathan Schisler	Biochemistry
145: Breaking Barriers in Vaccine Injury Compensation: A Data-Driven Analysis of Success Rates and Challenges	Olivia Lee	North Carolina School of Science and Mathematics	Dohyun Lee	Nursing and Public Health
146: A Novel Leaf Color Phenotype in the Semi-evergreen Sand Laurel Oak, Quercus hemisphaerica	Aubrey Church, Kaitlyn Mize	High Point University	Megan Bowman	Biology
147: Phage Hunting: Isolation of Novel Pseudomonas Bacteriophages	Michelle Hernandez	Catawba College	Amanda Rushing	Biology
148: Design and Testing of Simultaneous Ozone Suppression and Thrust Enhancement of Dielectric Barrier Discharge Plasma Actuators using Ultraviolet Light	Baya Belgaied	North Carolina School of Science and Mathematics	Michael Falvo	Engineering

149: Combining Boundary Scores with ModelGuard-S for Targeted Defense Against Model Extraction Attacks	Cayman Powell	University of North Carolina at Charlotte	Liyue Fan	Computer Science
150: Social Information Processing and Inequality	Ryleigh Knox, Jada Clark	University of North Carolina at Charlotte	Lisa Walker	Sociology
151: Investigating the Regulatory Elements of Plasmid Mediated Gene Expression	Aishwarya Arulprakasam	North Carolina School of Science and Mathematics	Bobby Warren	Biology
152: Vanillin-Derived Polymers: A Sustainable Path to High-Efficiency Organic Solar Cells	Keisi Orellana	University of North Carolina at Asheville	Jeromy Rech	Chemistry
153: Understanding H5N1 Cross-Species Transmission: A Time-Series and Geospatial Analysis into Environmental Variables	Rachel Alexander	University of North Carolina at Charlotte	Daniel Janies	Biology
154: Dynamic Disulfide Exchange in Molecularly Imprinted Polymers for improving sensitivity and batch reproducibility of electrochemical lactate sensors	Rejoy Rajesh, Advait Damle, Ankit Durbha	North Carolina School of Science and Mathematics	David Probst (Affiliated with UNC-Chapel Hill)	Biochemistry
155: Lake Norman Water Quality During Drought and Over 20 Years: A Spatiotemporal Analysis	Asher Spevak	North Carolina School of Science and Mathematics	John Paul Balmonte	Environmental Science and Sustainability
156: Do Latin Roots Help Students Remember Spanish Vocabulary?	Abdullah Shirolkar	North Carolina School of Science and Mathematics	Kristin Connor	Linguistics and World Languages
157: Impact of childhood trauma on students in care work education	Suhani Dadhania	University of North Carolina at Charlotte	Julie Gibbons	Health and Human Development
158: Maternal Social Support & Postpartum Stress and Anxiety	Meghana Chebbi	Meredith College	Betty-Shannon Prevatt, Pamela Norcross	Psychology

159: Policy Adaptation Targeting Common Hard Failures in Robot Manipulation with SmolVLA	WONJUN CHOI	Queens University of Charlotte	Chase Wrenn	Engineering
160: Assembling Tick Mitochondrial Genomes from Somalia & The Gambia	Katoria McMullen, Kaila King, Isheca Bailey, Zoe Migioni	Johnson C. Smith University	Rafael Felipe Da Costa Vieira	Biology
161: Relationships Among Feelings of Imposter Syndrome, Negative Self-Concept, Workaholism, and Organizational Citizenship Behaviors	Shatvika Sriram	Meredith College	Candalyn Rade	Psychology
162: Affordable Polymer Dispersed Liquid Crystal (PDLC) Smart Glasses to Minimize Photosensitive Epileptic Seizures	Hridya Ajith, Grace Kang	North Carolina School of Science and Mathematics	Sunil Nair	Engineering
163: Predicting Before It's Too Late: Machine Learning for Early Identification of At-Risk Students	Sujay Datla, Ruthvik Kantipudi	North Carolina School of Science and Mathematics	Dr. Amirhossein Ghasemi	Computer Science
164: Condensed SIR Modeling on Residential School Contact Networks	Satvik Kunam, Pranav Yaramalla	North Carolina School of Science and Mathematics	Hannah Schwartz	Nursing and Public Health
165: Testing induced resistance in Pleurotus djamor mycelium following exposure to live and UV-killed Bacillus subtilis	stella payne	Gaston College	Marguerite Bishop	Biology
166: Longitudinal Clinical and Cognitive Trajectories Across Alzheimer's Disease Diagnostic Stages: Evidence from ADNI	Chand Mallangi	University of North Carolina at Charlotte	Zheming Gao	Health and Human Development

167: Evaluating the Antibacterial Efficacy of Neat Botanical Oils Against Staphylococcus aureus	Rachel Henninger	Gaston College	Marguerite Bishop	Biology
168: Ion Motion in Organic Conductors for Neuromorphic Devices	Grant Ozaki	North Carolina State University	Paschalis Gkoupidenis	Engineering
169: Inhibition of VTA Dopamine Neurons Blunts Motivated Behaviors	Erin Kirsten Atos	University of North Carolina at Chapel Hill	Maddi Roth	Psychology
170: Isolating the discrepancy: Testing insulator activity of exogenously expressed CTCF in yeast	Will Brady	Wingate University	Brett Schofield	Biology
171: Assessing the Accuracy of Two-Dimensional CFD in Predicting the Effects of Cowl-Lip Position and Shoulder Rounding on a Mach 3.8 Supersonic Inlet	Yug Gokharu	North Carolina School of Science and Mathematics	Emma Cavanaugh	Engineering
172: Using Pressure Sensitive Walkways to Detect Weight Distribution Changes Associated with Canine Osteoarthritis	Hansika Malapati	North Carolina School of Science and Mathematics	Morgan Ferrans	Interdisciplinary Studies
173: Healing Through Music: The Benefits of Music Therapy for Individuals with Parkinson's Disease	Katelyn Koon	University of North Carolina at Charlotte	Vaughn Schmutz	Health and Human Development
174: Supporting Active Living on Campus: Factors Influencing Cycling Among UNC Charlotte Students	Riley-Finch Nehl, Ryleigh Massey	University of North Carolina at Charlotte	Allissa Desloge	Nursing and Public Health
175: Investigating the Synergistic Effect of Heme on Artemisinin-induced Ferroptosis in Cancer Cells	Mariangel Noriega	Catawba College	Carmony Hartwig	Biochemistry

176: Quantifying Genetic Structure in Mecklenburg County Dragonflies	Avery Taylor	University of North Carolina at Charlotte	Sandra Clinton	Environmental Science and Sustainability
177: Assessing and Optimizing Public Transit Accessibility in Charlotte through Optimal Transport Analysis	Bryan Tran	University of North Carolina at Charlotte	Xingjie Le	Computer Science
178: Recovering Sensor Fusion Latency Through System-Level Changes in Autonomous Vehicle Pipelines	Alan Cai	North Carolina School of Science and Mathematics	Zhishan Guo	Computer Science
179: Optimization of a Biofilm Assay to Study Pseudomonas aeruginosa Growth on Medical Materials	Emelyn Jackson	Campbell University	Leila Reyes Ruiz	Biology
180: Creativity of Public Music Performance in Charlotte	Michael Lusardi	University of North Carolina at Charlotte	Cindy Gilson	Music
181: Aye-aye Maternal Peripartum Behaviors	Sawyer Roy, Katie Heath, Sydney Brown, Charlotte Stewart	North Carolina State University	Lisa Paciulli	Biology
182: When Does Simplicity Win? Comparing Classical and Deep-Learning Methods for High Dimensional Portfolio Risk Management	Michael Gyimadu	Wingate University	Lisa Schwartz	Mathematics
183: Evaluating the Effects of Blocking Peptide MHCP3 on Dendritic Cell Antigen Presentation in MASLD	Emily Flynn	North Carolina State University	Arion Kennedy	Biochemistry
184: Relating dragonfly family diversity to habitat quality	Victoria Karavayeva	University of North Carolina at Charlotte	Sandra Clinton	Environmental Science and Sustainability
185: Creativity in Policing	Emma Barker	University of North Carolina at Charlotte	Cindy Gilson	Criminology/Criminal Justice

186: How DNA Barcoding Can Be Used to Identify Local Bumble Bee Species to Better Protect and Conserve the Endangered Species	Isabelle Douek	North Carolina School of Science and Mathematics	Mary Caroline Wolf Staton	Environmental Science and Sustainability
187: Prompt-to-Product: Integrating Artificial Intelligence and Guided Inquiry into an Undergraduate Biodiesel Laboratory	Anna Venditti	High Point University	Sarmad Hindo	Chemistry
188: Circadian Regulation of DNA Replication and Repair in the Skin	Sai Saanvi Ade	North Carolina School of Science and Mathematics	Shobhan Gaddameedhi	Biology
189: Evaluating the Effects of Thumb Joint Immobilization on Hand Function	Justin States	North Carolina A&T State University	Dustin Crouch	Engineering
190: Education Is a Signaling Game: How Community Differences Shape Labor?Market Outcomes	Simeon Davis	High Point University	Brandon Dragone	Economics
191: Exploring The Effects of Salinity Induced Osmotic Stress on Seed Germination and Early Seedling Development	Sreeya Bade	North Carolina School of Science and Mathematics	Jennifer Williams	Biology
192: Benchmarking Edge AI's Performance in Assisting Construction Plan Reading Learning Using Meta AI Glasses	Saniya Pritchett	University of North Carolina at Charlotte	Dr. Gongfan Chen	Engineering
193: Evaluating the Link Between BRCA1 Protein Domains and Variant Severity Using NIH Clinical Data	charvi parikh, Navya Sharma	North Carolina School of Science and Mathematics	Ripal Parikh	Biology
194: Evaluating BL41 Cells as a Model for Epstein-Barr Virus Infection	Divya Vijay	North Carolina School of Science and Mathematics	Jenna Grabowski	Biology

195: Digitizing the ETAP Field Data Card: A Shiny Application for Community Cleanup Events	Jack VanValkenburg	Queens University of Charlotte	Sveinn Einarsson	Environmental Science and Sustainability
196: Hitchhikers Informants: An Investigation into Potential Transference of Microbial Population During the Handling of Unfired Ammunition	Amaya Scott	Fayetteville State University	Khalid Lodhi	Biology
197: Modeling the Effect of Diamond Layer Thickness and Interface Resistance on Peak Temperature in Copper Heat Sinks	Sohum Vajaria	North Carolina School of Science and Mathematics	Anuveer Chada	Computer Science
198: Investigating the Effect of Hyaluronic Acid and Methacrylated Hyaluronic Acid Ratios on Molecular Release	Kamalika Kollati	North Carolina School of Science and Mathematics	Jillian Perry	Biology
199: Antimicrobial Activity, Biofilm Inhibition, and GC-MS Profiling of Origanum vulgare (Oregano) Against Clinical Isolates of Bacteria	Karem Hernandez	Winston-Salem State University	Dr. Akamu Jude Ewunkem	Biology
200: Computational Identification of RNA Thermometers in Fungi and Their Potential Role in Temperature Adaptation	Jayden Morales	Queens University of Charlotte	Rebecca Guth-Metzler	Chemistry
201: US Domestic Radicalization and Extremism: Elements, Stages, Deradicalization and Recommendations for Law Enforcement and Professionals	Max Salerno	Gardner-Webb University	Jim Rennie	Criminology/Criminal Justice

202: Documenting road mortality in Carolina Sandhills national wildlife refuge	Gage Caldwell	Montreat College	Joshua Holbrook	Environmental Science and Sustainability

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Abstracts

Health Inequalities in South Africa: How HIV Policy Interventions Impact HIV Incidence Rates in the Western Cape and KwaZulu-Natal

Naami Abbey

Mentored by: Stephanie Norander

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Since the global HIV crisis spiked in the 1980s, South Africa has experienced the largest HIV epidemic worldwide, with eight million people living with HIV, occurring at a prevalence rate of 13.3% in the adult population. This study investigates the relationships between HIV incidence rates and policy interventions by examining the differences in methods and policies used in evaluation and mitigation across different provinces. Understanding these differences is important because HIV is a preventable disease that often gets spread due to lack of education/misinformation within vulnerable communities or inaccessibility to healthcare. However, despite previous research conducted within each province, there is little to no literature comparing provincial strategies or their levels of efficacy. Through comparative analyses of the current literature, it was determined that the KwaZulu-Natal province displayed the greatest improvements in HIV containment and new infections, while, the Western Cape Province experiences higher incidence rates. As a result, this study demonstrates the need for more substantial research to identify the success factors that have enabled progress towards decreasing incidence rates in KwaZulu-Natal and implementing those policies across the country. Additionally, it demonstrates that the incidence of the HIV epidemic can be significantly reduced if municipalities work in collaboration with healthcare providers to educate community members and provide them with the appropriate knowledge and tools to prioritize their health. This work contributes to the goal of eradicating the HIV epidemic and provides insight into how communication in policy formation across different perspectives can facilitate meaningful contributions to public health.

Beyond the Taboo: Menstrual Equity on a Local and National Scale

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Women in the United States are experiencing period poverty, which is defined by the deprivation of menstrual products, hygiene facilities, waste management, and menstrual education. In 2025, an estimated 16.9 million people in the U.S. experienced period poverty. Combating period poverty requires a multifaceted approach, which requires the involvement of a whole-society, policymakers, non-profit organizations, educational institutes, and governments. In 2022, the World Health Organization (WHO) asserted that menstruation should be treated as a broader matter of health and human rights rather than a mere hygiene issue. This research explores the multidimensional implications of menstrual inequity particularly the psychological stress of anxiety and shame, the physical burden of managing cycles without adequate products, and the social isolation that arises from missing work or school. Additionally, it highlights the structural and economic barriers present in North Carolina that affect menstruating individuals. Research indicates an urgent need for policy and budget reforms to ensure free or affordable menstrual products, expansion of safe sanitation facilities in schools and workplaces, and the destigmatization of menstruation.

Circadian Regulation of DNA Replication and Repair in the Skin

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The skin is the body's first barrier against environmental stressors, including ultraviolet (UV) radiation, which is the leading cause of skin cancer. To cope with predictable daily changes in these exposures, skin cells use an internal 24-hour circadian clock that times key cellular processes. This project asks how the skin circadian clock coordinates DNA replication and DNA repair, and what happens to skin health when the clock is disrupted. Building on studies in mice and human tissue, we conducted a literature review of the molecular circadian clock, its control of the cell cycle and oxidative metabolism in epidermal cells, and its regulation of nucleotide excision repair, the main pathway that removes UV-induced DNA damage. Evidence linking circadian disruption, such as shift work, irregular light exposure, and altered clock genes, to skin disease is also evaluated. The literature shows that the clock separates DNA synthesis from periods of high oxidative stress and that repair activity, driven by rhythmic levels of the repair protein XPA, varies with time of day, so identical UV exposures can cause different amounts of damage. Disrupting the clock is associated with weaker genome protection, premature aging, skin cancer, and inflammatory conditions such as psoriasis. Most findings come from nocturnal mouse models, so human studies are needed. Understanding these rhythms could support time of day strategies for sun protection, prevention, and treatment in dermatology.

A Multi-State County-Level Analysis of the Impact of COVID-19 in the United States: Preparedness, Resource Allocation, and Disparate Outcomes

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Mentored by: Agbor Ebot

Livingstone College

A Multi-State County-Level Analysis of the Impact of COVID-19 in the United States: Preparedness, Resource Allocation, and Disparate OutcomesThe COVID-19 pandemic exposed structural inequities in the United States, with consequences varying across geographic and socioeconomic contexts. Building on research examining pandemic outcomes at state and national levels, this proposed study asks how county-level preparedness, resource allocation, and local conditions relate to differences in pandemic outcomes across selected states. Counties will represent diverse geographic, political, demographic, and economic profiles. The study will examine public health infrastructure, hospital capacity, emergency planning, and the distribution and use of federal and state funding, medical supplies, vaccines, and staffing support. Outcomes will include infections, hospitalizations, mortality, unemployment, small business closures, learning loss, and mental health challenges. The analysis will also consider partisanship, urban-rural differences, racial and ethnic disparities, pre-existing health conditions, and broadband access. A mixed-methods design will combine quantitative data from the Centers for Disease Control and Prevention, U.S. Census Bureau, Bureau of Labor Statistics, Department of Health and Human Services, and county financial audits with qualitative analysis of county commission minutes, emergency declarations, and media reports. The study is expected to identify patterns of resilience and vulnerability across state boundaries and potential practices associated with effective resource use and crisis response. By examining variation within and across states, this research aims to inform more equitable resource allocation and strengthen local preparedness for future public health emergencies.

A Systematic Review of Nickel Doping and Dye-Sensitization on TiO2 for Sacrificial Agent Free Hydrogen Evolution

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Mentored by: Michael Bruno

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The environmental impacts and finite supply of fossil fuels have increased interest in renewable energy sources, such as hydrogen gas. However, most hydrogen gas is currently produced from fossil fuels, limiting its sustainability. Photocatalytic water splitting offers a cleaner alternative by using light energy and a photocatalyst to split water into hydrogen and oxygen. Titanium dioxide (TiO2) is a promising photocatalyst, however, its large band gap restricts light absorption to the ultraviolet spectrum, while rapid electron-hole recombination reduces its efficiency. This research aims to enhance the photocatalytic performance of TiO2 by reducing the band gap to accommodate in the visible-light spectrum and minimizing electron recombination through dye-sensitization and metal doping. TiO2 was modified using nickel doping and anthocyanin dye extracted from blackberries, resulting in four photocatalytic combinations: unmodified TiO2, dye-sensitized TiO2 (Dye-TiO2), nickel-doped TiO2 (Ni-TiO2), and dye-sensitized nickel-doped TiO2 (Dye-Ni-TiO2). Cyclic voltammetry and UV-Vis spectroscopy was used to determine band-edge positions and evaluate the feasibility of the photocatalytic water splitting system. Photocatalytic performance was then assessed in a sealed reaction apparatus under visible-light irradiation, with gas production measured by water displacement. Preliminary results suggest that the band-edge of anthocyanin dye, nickel, and TiO2 may be favorably aligned to support charge transfer and facilitate water-splitting reactions. Initial testing also demonstrated gas evolution under visible light. Future work will focus on maximizing hydrogen production, completing electrochemical observations, and controlling for heat. These findings may contribute to the development of more efficient TiO2-based photocatalysts for renewable hydrogen gas production.

Teacher Training for Supporting Autistic Students in Inclusive Classrooms: From Evidence to Classroom Practice

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More autistic students are in U.S. classrooms than ever before, but teachers and teaching assistants say they have had little training in most of the classroom strategies that research supports. This review looks at research on classroom supports, teacher training, inclusion, teacher confidence, and what autistic people themselves say about the goals of these strategies. Three findings stand out. First, the classroom strategies teachers are told to use have real support behind them, but the strength of that support varies a lot from one strategy to the next. Second, training is much more likely to change what a teacher actually does when it is specific, hands-on, and followed by coaching, though the evidence that training raises teacher confidence is stronger than the evidence that it changes classroom practice or student results. Third, placing an autistic student in a general classroom does not help by itself; what matters is the quality of support inside that classroom. Together, these findings point to a model of teacher training that combines basic knowledge with practice, coaching, and attention to what autistic students actually want from school. The review also points out weak spots in the research, including a shortage of large studies, heavy reliance on small studies and self-reported surveys, and the small role autistic people have played in deciding which outcomes count as success.Keywords: autism spectrum disorder, teacher training, evidence-based practice, inclusion, teacher self-efficacy, implementation fidelity

Predicting Autistic Meltdowns from Wearable Biosensor Data: A Subject-Wise Comparison of Feature-Based and Deep Learning Models

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Autistic meltdowns are episodes of intense distress triggered by overwhelming sensory, emotional, or environmental stimuli. These events can create significant challenges for autistic individuals, caregivers, educators, and support staff. Although prior research has investigated stress detection using behavioral monitoring and camera-based systems, relatively little work has focused on predicting autistic meltdowns using wearable physiological sensors. Even fewer studies have directly compared traditional machine learning methods with deep learning approaches using the same multimodal wearable dataset. This study evaluates the effectiveness of five machine learning and deep learning models for predicting impending autistic meltdowns from wearable sensor data: Logistic Regression, Random Forest, a Convolutional Neural Network (CNN), a Long Short-Term Memory network (LSTM), and a hybrid CNN-LSTM architecture. The study also compares its methodology and findings with those reported by Vos et al. (2023), Ali and Saravanan (2023), and Singh (2022).Data were obtained from the Autism Together Hackathon Dataset (2022), which contains recordings collected using the Empatica E4 wristband from eight autistic participants. The dataset includes six physiological signals: accelerometry (ACC), blood volume pulse (BVP), electrodermal activity (EDA), heart rate (HR), inter-beat interval (IBI), and peripheral skin temperature. Data were sampled at one-second intervals over approximately one day per participant, producing 690,854 observations and 43 documented meltdown episodes.Physiological signals were segmented into overlapping 60-second windows with a 30-second stride. Each window was labeled according to whether a meltdown would occur within the following five minutes, ensuring that no information from the prediction period was included in the input data. Missing values were imputed, and features were standardized using statistics derived solely from the training data. Model performance was evaluated using leave-one-subject-out cross-validation, in which each participant was held out in turn while the models were trained on the remaining seven participants. Performance was measured using ROC AUC, PR AUC, F1-score, precision, recall, and the Matthews Correlation Coefficient (MCC).Feature-based machine learning models substantially outperformed deep learning approaches. Random Forest achieved the best overall performance (ROC AUC = 0.968, PR AUC = 0.702), followed closely by Logistic Regression (ROC AUC = 0.964, PR AUC = 0.647). Deep learning models performed considerably worse, with CNN-LSTM achieving a ROC AUC of 0.685 and PR AUC of 0.082, while LSTM and CNN achieved ROC AUC scores of 0.653 and 0.651, respectively. Random Forest also demonstrated the greatest generalizability across participants, never scoring below 0.937 ROC AUC, whereas deep learning performance varied substantially between individuals. Heart rate variability, skin temperature variability, and electrodermal activity variability emerged as the most informative predictive features.These findings demonstrate that multimodal wearable sensor data can support accurate prediction of impending autistic meltdowns and extend prior work involving heart-rate anomaly detection (Khullar et al., 2019), camera-based behavioral recognition (Sindhoor Preetham et al., 2017), and single-participant wearable models (Singh, 2022). Contrary to expectations, simple statistical features extracted from physiological signals consistently outperformed deep learning models trained on raw sensor data. The results further highlight the importance of rigorous validation in biomedical machine learning. These findings suggest that wearable biosensors may provide a practical and scalable approach for identifying early signs of an impending autistic meltdown before it occurs.Keywords: autism spectrum disorder, meltdown prediction, machine learning, wearable biosensors, electrodermal activity, LSTM, Random Forest, CNN-LSTM.

The Private Cost Paradox: Attention as a Negative Externality in Digital Capitalism

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Mentored by: David Cantrell

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The monetization of human attention has restructured market incentives within digital capitalism, producing a textbook case of negative externality: a structural divergence between private user cost and social cost. Drawing on economic theory and behavioral psychology, we argue that when engagement metrics become standardized in investor valuations, companies optimize for the metric rather than user welfare. This marks a new form of capitalism that contradicts the traditional feedback loop where consumer harm triggers market correction. Through analysis of Meta and Snapchat investor presentations and quarterly reports, this paper documents how attention metrics (Daily Active Users, time-on-app, ad impressions) function as primary drivers of firm valuation. The resulting market failure is what this paper calls the Private Cost Paradox: users perceive a private cost of zero, while absorbing social costs that, unusually, may exceed that private cost by orders of magnitude rather than merely at the margin. Unlike traditional commodities, in which costs and benefits accrue to the same actor, attention-based business models systematically separate who profits from consumption from who bears its cost. We document three dimensions of monetarily quantifiable social costs: adolescent mental health, workplace productivity, and algorithmic recommendation polarizing political beliefs. Finally, it is analyzed why the system persists despite documented harm. Responsibility is structurally diffused across users (rationally responding to zero price), product teams (optimizing for investor expectations), and investors (rewarding engagement metrics). Each actor's rationality insulates the system from correction. This represents a deliberate economic choice, raising fundamental questions about accountability of the attention economy.

Invisible Strings: The Hidden Influence of Parental Psychological Control on Adolescent Emotion and Behavior

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Parental psychological control, or the use of intrusive and manipulative behaviors that target children's thoughts, feelings, and behavior, is a powerful influence on child and adolescent development, shaping emotional, social, cognitive, and behavioral functioning. Yet, the ways in which psychologically controlling parenting influences children's emotional experiences and behavior remain an important area of inquiry, particularly when children's autonomy and emotional perspectives are repeatedly undermined. Parental psychological control may influence children's interpretations of language, relationships, and emotional experiences. This literature review aims to identify emotion regulation as a potential mechanism linking psychologically controlling parenting to maladaptive developmental outcomes. Specifically, chronic exposure to psychologically controlling family environments may interfere with a child's ability to identify, understand, and regulate their emotions. This exposure increases the likelihood of children developing maladaptive emotion regulation strategies that contribute to unhealthy patterns of emotional expression and behavior. Existing evidence on these processes has significant implications for child and adolescent development and highlights the importance of parental education and evidence-based interventions that promote emotional validation, independence, and healthy parent-child relationships. By focusing on children's emotional experiences, this review emphasizes the importance of clinicians and educators supporting children whose voices may be minimized within controlling family dynamics and fostering environments that support healthy emotional development and reduce risk for psychopathology.

Affordable Polymer Dispersed Liquid Crystal (PDLC) Smart Glasses to Minimize Photosensitive Epileptic Seizures

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Mentored by: Sunil Nair

North Carolina School of Science and Mathematics

Photosensitive epilepsy is a condition that triggers seizures in patients when exposed to visual stimuli like flashing lights or contrasting patterns that disrupt neuronal activity. Current glasses for photosensitive epilepsy patients cost hundreds of dollars and do not yield promising results for all patients. By using cost effective material such as 3d printing, we aim to produce affordable and customizable epilepsy glasses.This paper introduces Polymer Dispersed Liquid Crystal (PDLC) Lense Smart Glasses that help to block out a majority of the flashes using PDLC. The PDLC is envisioned to be used as the lens of smart glasses that are coded and programmed to respond to stimuli, along with customizations such as autocalibration in different environments and warning the patient based on how sensitive the patient is to different levels of stimulus. A Seeed Studio XIAO ESP32 S3 Sense camera was used to monitor light brightness and frequency, while an ESP32 microcontroller controlled a relay to switch the PDLC film between transparent and opaque states. Testing demonstrated that the camera maintained stable readings when the user's head was still. Head movement introduced additional fluctuations, highlighting the need for multiple high-delta thresholds in the Arduino IDE code to prevent false positives. Results indicate that the system reliably detects flashing light and triggers the PDLC response under controlled conditions, though movement and increased distance reduce detection accuracy. These findings support the feasibility of real-time, wearable seizure-prevention glasses that actively protect users from harmful light stimuli while maintaining normal vision under safe conditions.

Hollywood Intervention: Industry Coordinator- a Pre and Post Case Study

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Mentored by: W. Russell Robinson

Winston-Salem State University

In October of 2017, the American entertainment industry became the epicenter of global attention from a deluge of allegations regarding sexual misconduct. High-profile celebrities from NBC's flagship morning news program, The Today Show's Matt Lauer, to America's Dad, Bill Cosby, to the now-infamous film mogul Harvey Weinstein, were all connected to the social media movement, #MeToo. Accessibility for sexual favors in the business of Hollywood represents an age-old practice going back to the early days of show business. However, in the global ecosystem of algorithms and social media, this predatory practice calls for immediate reforms, which is the focus of this project: the intimacy coordinator. This presentation is a case study on the role of Intimacy Coordinators within the film and television industry, focusing on labor practices, consent, and autonomy through the lens of Feminist Media Theory. This study will analyze how the role not only challenges but also changes traditional power dynamics and structures within the entertainment industry, both pre- and post-advent of the intimacy coordinator. Further, this research will investigate the effectiveness of this now industry-standard intervention and offer informed, research-based recommendations from this study's findings.

The Impact of Social Media Exposure on Attention and Performance Among College Students

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Elizabeth City State University

This research topic is concerning how social media has become a major part of everyday life, especially among college students. This study examined whether using social media immediately before completing an attention task affects students' ability to concentrate and perform. The purpose of this study was to determine whether a short period of social media use could influence attention and performance among college students. Participants were ECSU students between the ages of 18 and 30. Participants were randomly assigned to either a social media group or a control group. Participants in the social media group spent approximately 10 minutes using social media platforms such as Instagram, TikTok, or Facebook, while the control group did not use social media before completing the attention task. After the assigned activity, participants completed an attention and concentration assessment using an online survey and quiz. The results were compared between the two groups to determine whether there were differences in attention performance. The findings provide information about the possible short-term effects of social media use on attention among college students. Understanding this relationship may be helpful because students frequently use social media while studying, attending classes, or completing academic tasks. The study may also help students become more aware of how their social media habits could affect their ability to focus. Overall, this research contributes to a better understanding of the relationship between short-term social media use and attention in college students.

College Students with Autism: Academic Challenges and Support Systems

Alaija Alexander

Mentored by: Leslie Bross

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The transition to college can create significant academic, social, and emotional challenges for students with autism, particularly as increased independence, reduced structure, and social expectations may contribute to anxiety. Yet, traditional university support systems often focus primarily on academic accommodations and may not fully address the emotional, social, and environmental factors that influence autistic students' college experiences. The goal of this literature review is to examine the relationship between autism and anxiety in college-aged individuals, how anxiety affects academic performance, independence, and quality of life, and the extent to which formal and informal supports address anxiety-related challenges. Synthesizing peer-reviewed research across psychology, education, neuroscience, and special education studies, this review identifies several central themes, including co-occurring mental health conditions, the transition to college, formal academic supports, informal support networks, and systemic barriers within higher education. Findings indicate that anxiety is highly prevalent among autistic students and can affect cognitive functioning, emotional regulation, academic engagement, social participation, and independence. Although formal accommodations are important for improving access to education, they often do not address broader emotional and social needs. These findings suggest that supporting college students with autism requires a more comprehensive approach that integrates academic, social, mental health, and environmental supports. This research contributes to the understanding of how universities can move beyond reactive accommodations toward more proactive and inclusive systems that promote both academic success and quality of life.

Understanding H5N1 Cross-Species Transmission: A Time-Series and Geospatial Analysis into Environmental Variables

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Mentored by: Daniel Janies

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Beginning as early as 2022, egg prices in the United States have steadily increased, with a marked upsurge in 2024 due to the outbreak of Highly Pathogenic Avian Influenza (HPAI) H5N1 subtype. H5N1 is a strain of influenza A virus that predominantly infects wild and domestic birds, including egg-laying hens. Beyond birds, other animals have also been infected, such as mammals, with cases documented in feline, bovine, and human hosts. In addition to the expanded host range of H5N1, seasonality is becoming increasingly apparent in the H5N1 epidemic, as cases rise in the winter months in North America. The combined effects of host range expansion and seasonality make H5N1 cross-species transmission a major concern for public health and agriculture. Current literature on H5N1 environmental epidemiology focuses on single variables. Studying environmental factors in combination is critical to capture their complex interactions and achieve a comprehensive understanding of the H5N1 epidemic. In this research, we will analyze the combined impacts of seasonal temperature, migratory bird timing, and precipitation patterns via quantitative and qualitative analyses. The quantitative analysis will be conducted via Generalized Additive Modeling (GAM) to create a function that quantifies each variable's impact and predicts future epidemiological outcomes. Qualitative analysis will be conducted through the creation of an interactive Tableau™ dashboard. In tandem, these methods provide insight into the covariates of spread for H5N1 and predict future outcomes to improve our understanding of changes in its epidemiology.

Development and Optical Characterization of an Epidermal Tissue Phantom for Enhanced Thermal Imaging

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Enhanced Thermal Imaging (ETI) is a novel, noninvasive technique developed in our lab to improve the visualization of blood vessels. By using LED illumination to gently heat blood within the vessels, ETI generates a temperature differential that is captured by a thermal infrared camera. This localized heating effectively acts as a thermal contrast agent, making the underlying vasculature visible. However, the inherent variability of biological tissue makes it difficult to reliably optimize the ETI technique. As an alternative, tissue-mimicking phantoms provide a controlled testing environment. We previously developed a custom dermal tissue phantom that replicates both the optical and thermal properties of human skin. However, this model lacked an epidermal layer containing melanin, restricting our ability to evaluate how varying skin pigmentation influences light absorption and heat distribution.To address this, we have developed a multi-layered phantom that incorporates a simulated epidermal layer. Cosmetic makeup powders of two distinct shades were utilized to replicate different skin tones. A thin layer of powder was brushed onto the surface of our existing dermal gelatin phantom to simulate the epidermis. We then measured the absorption and scattering properties of this additional layer using an integrating sphere and the inverse adding-doubling method. Our initial measurements revealed that the absorption of the powder layer was lower than that of real tissue. To resolve this, we are currently incorporating a broad-spectrum absorber into the powder mixture. This preliminary data provides a clear baseline to iteratively refine the composition of the epidermal layer to match biological properties.

Leavering Photodegradation to Create a Method of Closed-loop Recycling for Conjugated Polymers

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University of North Carolina at Asheville

Organic solar cells are an emerging technology with most research prioritizing high efficiency. As most of the blends in these systems utilize conjugated polymers (e.g. plastics), considerations should be made for the end of life for the materials, especially considering the impact which traditional plastics have had on our environment. While there are no reports of fully recyclable conjugated polymers, previous research has shown that some/most of these materials can degrade over time. The mechanism and extent of degradation can vary based on the patent polymer. For example, when poly[2-methoxy-5-(2'-ethylhexyloxy)-p-phenylene vinylene] (MEH-PPV) is exposed to a combination of light and oxygen there is a rapid loss in efficiency and eventually complete failure of the solar cell device. In this work, we explore the degradation of MEH-PPV as a proxy to understand and potentially leverage the stability issues to design fully recyclable conjugated polymers. We have explored a variety of conditions which trigger polymer breakdown and fully characterize the resulting degradation products. Additionally, we've demonstrated a synthetic approach to resynthesize the parent polymer from the degradation components. With this understanding, we have also designed and synthesized a series of new donor moieties which offer promise towards programing when the polymer breaks down (i.e. under specific stimuli). This work provides a foundation for future research in fully recyclable conjugated polymers.

The Ghost of Hammock House: Folklore's Impacts Economic Development

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Mentored by: Meltem Safak

North Carolina School of Science and Mathematics

Folklore captures people's imaginations and memories in ways that shape individual and collective identities. While these stories rooted in history can bring communities together through a sense of belonging, they can also negatively impact the health and development of a community when they create fear. This project examines the lore surrounding the Hammock House in Beaufort, NC, and its impact on the area's economic development. As the oldest home in Beaufort, built in the 1700s, the Hammock House has averaged a new owner about every 10 years. Through archival research and close reading of primary sources, I identified ways in which community beliefs surrounding the ghost of Hammock House may have stifled opportunities for the property's development and use. The lore around the ghost of Hammock House continued to grow through the decades and remains part of Beaufort's cultural narrative today. Recently, these ghost stories have been embraced and incorporated into local tourism, including ghost tours and retellings of Blackbeard's time in Beaufort, providing an economic benefit for the community. I presented my research findings in the form of an original poem that interprets the community's imagination surrounding the ghost of Hammock House. By combining scholarly research with creative expression, this project highlights the ways folklore can interpret and extend the meaning of historical sites.

Can Functional Foods Make Chemotherapy Safer? A Precision Microbiome Approach

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Chemotherapy regimens are frequently accompanied by adverse side effects including chemotherapy induced diarrhea (CID). Severe CID results from bacterial b- glucuronidases that deconjugate and reactivate inactive drug metabolites formed during host detoxification pathways. Bacteria-selective β-glucuronidase inhibitors alleviate CID in preclinical mouse models, though translation into humans has been slow. Probiotic functional foods like kombucha tea (KT) provide an alternative, complementary path to translation. This project investigates whether a specific KT-associated bioactive metabolite (KABAM) we discovered can inhibit bacterial β-glucuronidase activity thus reducing CID. A fluorescence-based kinetic assay measured β-GUS activity at baseline, and in the presence of the purified KABAM, revealing its inhibitory activity. By adding a precursor to the candidate KABAM, we prepared a "super brew" KT , which demonstrated greater in vitro β-GUS inhibition than standard KT. To identify additional health-promoting effects of KT, we used the polarized Caco-2 cell model of the intestinal epithelium to model CID. We found that Caco-2 exposed to the chemotherapeutic irinotecan along with KT have reduced cytotoxicity and enhanced barrier integrity. Our mechanism-driven findings that KABAM reduces β-glucuronidase activity, and that KT enhances intestinal cell health suggest that KT may be clinically leveraged to reduce CID. The potential of functional foods as an intervention for reducing the severity of CID is an exciting outlook for enhancing the safety and efficacy of chemotherapy.

Following the Electrons: Linking Cyclic Voltammetry and Quenching

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Thiazolothiazole (TTz) photocatalysts can undergo electron-transfer reactions when exposed to light, but their interactions with different electron-donating compounds are not fully understood. This project investigates how the structural and electronic properties of amines influence their ability to quench the excited state of a TTz photocatalyst. Fourteen amines were evaluated using Stern-Volmer fluorescence quenching experiments to measure their quenching efficiency. Cyclic voltammetry was also performed to determine the oxidation potentials of the amines and assess their electron-donating abilities. The Stern-Volmer constants were then compared with the measured oxidation potentials to identify relationships between electron donation and fluorescence quenching. The results demonstrated a clear inverse relationship between oxidation potential and Stern-Volmer constant. Amines with lower oxidation potentials generally exhibited fluorescence quenching efficiency, while amines with higher oxidation potentials showed minimal quenching and lower Stern-Volmer constants. These findings indicate that greater electron-donating ability corresponds to more efficient quenching of the excited TTz state. Understanding this relationship provides insight into how molecular structure and electronic properties influence photocatalytic electron transfer processes. This research may contribute to improving approaches for identifying organic compounds and support future applications of TTz photocatalysts in chemical sensing, photocatalytic development, and pharmaceutical research.

Evaluating Optimal Transport for Fine-Grained Text–Image Alignment

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Text-to-image systems are often evaluated using global similarity measures that may overlook fine-grained compositional errors involving object identity, missing objects, attributes, and unequal importance across concepts. This project investigates whether Optimal Transport (OT) can provide a more interpretable framework for fine-grained text-image alignment by explicitly matching requested textual objects to corresponding visual objects. We compare balanced OT, Hungarian assignment, and Unbalanced Optimal Transport (UOT) using controlled synthetic experiments that isolate missing objects, incorrect attribute labels, and non-uniform mass distributions. UOT transport plans are post-processed into discrete correspondences using a confidence threshold. Initial experiments show similar discrete performance among the methods for simple missing-object and wrong-label cases, while UOT provides greater flexibility when the text and image representations contain unequal or non-uniform mass. The next phase integrates pretrained computer vision and vision-language models, including object detection and region-level semantic embeddings, to extract objects and visual features from generated images and construct data-driven transport cost matrices. This will allow OT-based alignment to be evaluated on actual text-to-image outputs rather than manually defined object representations. The project aims to determine whether UOT can provide interpretable, fine-grained multimodal evaluation when visual correspondences are uncertain or incomplete.

Using Markov Chains To Model Same-Aircraft Delay Propagation Across Scheduled Turnaround Times

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One late arrival can become an entire day of delays for an aircraft, producing costs for airlines and passengers. Scheduled turnaround time (STT) can absorb delays but reduces aircraft utilization. In April 2026, American Airlines increased flight banks at Dallas Fort Worth International Airport to address delays. This study examined whether that change altered the relationship between STT and same-aircraft delay propagation, addressing limited research on hub restructuring across STT ranges. Over 18,000 domestic flight records from May 2025 and May 2026 were collected from the Bureau of Transportation Statistics. Arrivals were matched by tail number with the next departure of the same aircraft, then grouped by STT and classified into four delay states. Markov transition matrices were created for each group and raised to the fifth power to model delay propagation across an aircraft rotation chain. Across all four STT groups, aircraft were more likely to recover (2.7-4.8 pp) and less likely to remain largely delayed (1.3-7.4 pp). Shorter STTs showed strong reductions in severe delay persistence (up to 24.0 pp), while longer STTs showed greater movement toward on-time operation. An omnibus chi-square test revealed overall significance in system-wide changes ($\chi 2$ =118.6, p=1.3x10-8). These findings suggest that delay recovery depends on how efficiently time and resources are organized, not just STT duration. Although stochastic variables prevent direct causation, this study provides a practical method for identifying where severe delays are likely to persist, helping airlines and airports target resources while balancing aircraft utilization and passenger experience.

Olfactory Function For Everyone: Engineering an Accessible Approach to Olfactory Sensory Neuron Recovery

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Olfactory function declines with age, resulting in decreased quality of life. This condition, affecting both taste and smell, impairs an individual's ability to enjoy food, reduces their recognition of hazards in their environment (smoke, gas leaks, mold), and is correlated with increased anxiety levels and a greater incidence of depression. Olfactory therapy is the most effective and accessible standardized treatment to repair the senses of taste and smell. It requires repeated and intentional exposure to distinct odors, targeting olfactory sensory neurons, and rebuilding the neural pathways that enable scent perception, thereby increasing cellular regeneration and repairing the senses of smell and taste and boosting cognition. The research team has developed an experimental device that contains four recognizable scents in an accessible, compact unit that can be used to stimulate different olfactory receptor neurons among older populations. This device will be used by participants (aged > 75 years), who will smell each of the four scents twice daily for a period of three months. It is hypothesized that consistent and correct use of the training device will improve olfactory function, including scent identification, detection, and distinction.

Bartonella and Leishmania Detection within Sandflies

Bridget Appiah

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Sandflies are flying, biting, and blood-sucking arthropods that are known to be vectors of the causative agent of Leishmaniasis, a zoonotic disease that can be deadly for both animals and humans. This disease represents a Global Health problem, due to its presence in all countries surrounding the Mediterranean Basin and in most countries in North and South America (areas where the disease is endemic). Although sandflies are known to be the vector for several Leishmania species, little is known about their vector capacity for other zoonotic pathogens, such as Bartonella, in the Mediterranean Basin. This genus of bacteria is known to cause Bartonellosis, an infectious, zoonotic disease that can cause Carrión's disease, trench fever, cat-scratch disease, neurological disorders, and more. Beyond being able to transmit Bartonella bacilliformis (a potentially fatal pathogen in humans), some preliminary data generated by the Intracellular Pathogens Research Laboratory showed that other Bartonella species (such as B. henselae, B. bovis, and B. merieux) are present in sandflies. This study focuses on assessing the prevalence of different Leishmania and Bartonella species in sandflies collected from Italy, Portugal, and Iraq. The information gathered by this work, via DNA extraction, qualitative polymerase chain reaction (qPCR) assays, and conventional PCR assays, will help to assess the potential risks of zoonotic infections by exposure to sandflies. Our preliminary PCR data show positive DNA results for both Leishmania and Bartonella DNA in sandflies from each of the three targeted Mediterranean countries.

Investigating the Influence of Wind Forcing on Estuarine Circulation in the Albemarle-Pamlico System Using the General Ocean Model (GOM)

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North Carolina is home to one of the largest wind-influenced estuarine systems in North America, the Albemarle-Pamlico Estuarine System (APES). Previous studies have shown that wind forcing strongly influences numerous hydrodynamic processes within the estuarine system. Although the importance of wind forcing has been established, its interactions with tidal dynamics, specifically the transition between wind-dominated and tide-influenced hydrodynamic regimes, have not been fully quantified. In this study, the influence of wind forcing on circulation within the APES was quantitatively investigated using a high-resolution, newly developed hydrodynamic model, the General Ocean Model (GOM). GOM model results were used to evaluate the variability of wind influence and identify the transition between tidal- and wind-dominated hydrodynamic circulation using quantitative error analysis methods (Skill score, mean error, and mean absolute error). Results show that tidal forcing is dominant near ocean and inlet boundaries, while wind forcing becomes dominant within enclosed and upstream regions. These patterns help in the creation of spatial maps of tidal attenuation for boundary identification. These findings provide quantitative insight into the role of wind and tidal forcing within the APES and contribute to the honing of the GOM to ensure reproducible results in comparison with collected data, to continue to grow the understanding of hydrodynamic processes in wind-influenced estuarine systems.

Robust Directional Sensitivity and Radiofrequency Susceptibility in Dipolarly Coupled Radical-Pair Compasses

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Every year, millions of migratory birds undertake journeys spanning thousands of miles with remarkable precision. A significant cue guiding these journeys is magnetoreception, the ability to sense and orient using Earth's geomagnetic field. A leading explanation for this is the radical pair mechanism (RPM), in which light-induced electron transfer in cryptochrome proteins generates spin-correlated radical pairs whose quantum spin dynamics are influenced by the direction of the geomagnetic field. However, it remains unclear whether a radical-pair compass can maintain strong directional sensitivity while experiencing spin interactions, environmental dephasing, and weak radiofrequency perturbations. Beginning with a three-spin model consisting of two electron spins and one nuclear spin, I introduce electron-electron dipolar coupling and singlet-triplet dephasing before examining the response of parameter regimes that retain directional sensitivity to weak radiofrequency magnetic fields. Compass performance is quantified using the orientation-dependent singlet yield, $\Phi s(\theta)$, and its directional anisotropy, $\Delta\Phi s = \max(\Phi s) - \min(\Phi s)$. Preliminary simulations show that increasing dipolar coupling can strongly suppress directional sensitivity, while intermediate singlet-triplet dephasing can partially recover this response in selected parameter regimes. Radiofrequency simulations reproduce a resonant response near the expected electron Larmor frequency. Ongoing work tests whether the same parameter regions that preserve or enhance directional sensitivity also remain susceptible to weak radiofrequency perturbations. These results may help constrain the physical conditions under which a cryptochrome-based radical-pair compass could remain biologically viable and, more broadly, provide insight into how useful quantum behavior can persist in noisy environments relevant to robust quantum sensing and quantum technologies.

Investigating the Regulatory Elements of Plasmid Mediated Gene Expression

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Plasmids are independently replicating pieces of DNA that contain promoters, which are DNA sequences used to optimize gene expression. GCaMP6s is a fluorescent calcium indicator that can be used to measure gene expression and is typically expressed in a pGP backbone. This differs from a pCI plasmid backbone because it contains different promoter variants and an enhancer that influences gene expression. Despite their widespread use, there has been limited direct comparison between these two backbones. To address this, I compared the GCaMP6s expression between the pCI backbone and original pGP backbone by measuring GCaMP6s fluorescence. We found that the pGP backbone was able to express more GCaMP6s than the pCI backbone based on raw fluorescence values. At high concentrations, they were similar, but at lower concentrations, the expression difference is clearer. Comparing the pGP plasmid backbone with the pCI plasmid backbone improves our understanding of how regulatory elements affect expression levels and how to optimize gene expression based on concentration. I also investigated how specific binding pocket mutations affect the function of the insect odorant receptor MhOR5 in a heterologous cell system. Mutated MhOR5 plasmids were transfected into HEK293T cells and exposed to different concentrations of odors. Receptor activation was evaluated using calcium-dependent fluorescence, and the responses of each mutant were compared with the unmutated receptor to determine how mutations affected receptor sensitivity and function. A limitation is that differences in cell health may also influence fluorescence measurements.

Targeting Therapy-Induced Senescence in Triple-Negative Breast Cancer Cells Using 5-Aminolevulinic Acid-Mediated Photodynamic Therapy

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Triple-negative breast cancer (TNBC) is an aggressive subtype of breast cancer with limited targeted treatment options. Although some treatments induce cellular senescence, where cancer cells stop dividing, senescent cells remain metabolically active and can contribute to tumor recurrence. ClpP is a mitochondrial protein-degrading enzyme that regulates cell metabolism. Recent studies have shown that the ClpP activator TR-107 induces senescence in TNBC cells while degrading ALAS1, a key enzyme in heme biosynthesis. We hypothesized that senescent TNBC cells would rely on exogenous 5-aminolevulinic acid (5-ALA) to make heme, resulting in increased intracellular protoporphyrin IX (PpIX) accumulation and enhanced sensitivity to photodynamic therapy (PDT). 159WT TNBC cells were treated with TR-107 to induce senescence before receiving either 5-ALA or dimethyl sulfoxide (DMSO) as a control. Intracellular PpIX accumulation was quantified using a fluorescence-based metabolite assay following acetonitrile extraction. Cells were subsequently exposed to red-light PDT, and treatment response was evaluated by microscopy, Bradford protein assay, and Western blot analysis. Cells treated with 5-ALA accumulated approximately 11-fold more PpIX than DMSO-treated controls, demonstrating that senescent TNBC cells effectively convert exogenous 5-ALA into the photosensitizer required for PDT. Following red-light exposure, 5-ALA-treated cells showed extensive cell loss and an approximately 82% reduction in total protein content compared with DMSO controls, consistent with enhanced treatment response. Western blot analysis is currently being completed to confirm apoptotic cell death. These findings suggest that 5-ALA-mediated PDT may provide a strategy for selectively eliminating therapy-induced senescent TNBC cells in future cancer therapies.

MARS: A Tool Mediated AI Framework for Observational Astronomy

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Large language models are increasingly capable of coordinating complex scientific tasks, but their use in observational astronomy requires a reliable way to connect natural-language scientific goals with validated domain-specific software and, ultimately, real observing infrastructure. MARS, the MCP Astronomy Research Suite, investigates how frontier large language-model agents can support astronomical research while preserving scientific correctness, transparency, reproducibility, and human oversight. MARS builds on software developed for the Skynet Global Observatory and Astromancer, exposing astronomy capabilities through a common set of structured Python tools that can be used directly by compatible AI agents through the Model Context Protocol. Current capabilities include astronomical database and literature searches, astrometric analysis, aperture photometry and photometric calibration, pulsar time-series analysis, H-R diagram construction and fitting, and radio-source analysis. Rather than asking a language model to perform numerical astronomy itself, MARS keeps the scientific algorithms within established domain software while allowing the model to select tools, organize multi-step workflows, interpret results, and revise its approach when additional validation is required. The current system demonstrates that this architecture can support multi-stage astronomical analysis while retaining inspectable tool calls, intermediate data products, and session provenance. Future work will extend MARS to Skynet 2.0 observing resources, connecting scientific intent with telescope selection, observation construction, data acquisition, and subsequent analysis. MARS therefore provides a framework for developing transparent, tool-mediated AI systems for end-to-end observational astronomy.

Inhibition of VTA Dopamine Neurons Blunts Motivated Behaviors

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The ventral tegmental area (VTA) is a region in the brain implicated in reward and motivation. Use of all drugs of abuse, including alcohol, results in activation of VTA dopaminergic neurons and subsequent dopamine release in its target brain regions. This dopamine release is posited to be necessary for repeated drug seeking and consumption. Although this is supported by a vast body of literature, it is unclear whether binge alcohol consumption, a motivated and risky pattern of alcohol consumption that often precedes the development of alcohol use disorders, recruits these neurons. To verify the functional involvement of VTA dopamine signaling in binge-like ethanol consumption, adult TH-ires-cre mice on a C57Bl/6J background received a viral infusion of an inhibitory or control designer receptor exclusively activated by designer drugs (DREADD) into the VTA. Mice then underwent a series of behavioral tests to determine if chemogenetic inhibition of VTA dopamine neurons blunts motivated behavior including binge-like ethanol consumption, binge-like sucrose consumption, exploration of a novel environment, and remaining on a moving rod. Inhibition of VTA dopamine neurons significantly reduced all motivated behaviors tested without influencing anxiety-like behavior or locomotor ability, suggesting that VTA dopamine neuron activity is necessary for binge-like ethanol consumption and other motivated behaviors. This work builds on our lab's research into how neuroimmune signaling in the VTA influences binge-like ethanol consumption by supporting the possibility that neuroimmune manipulation of VTA dopaminergic signaling is a mechanism for promoting drinking behavior. Supported by NIH grants DA007244, AA013573, AA022048, AA025809.

Design of High Frequency Wireless Power Transfer for Drone Charging Application

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Drone technology has expanded rapidly over the past two decades, impacting numerous industries; however, operational uptime remains a critical limitation for battery-powered models. Wireless Power Transfer (WPT) offers a solution to extend uptime through strategically placed charging stations. Implementing WPT in drone applications introduces unique challenges, particularly the highly variable nature of power transfer efficiency regarding changing loads, distances, and orientations, alongside strict weight and size constraints. To achieve the necessary efficiency (>90%) and stability, this study utilizes high-frequency (500 kHz+) inductive resonant coupling. Specifically, a three-coil topology operating at 1 MHz was selected for its reduced weight profile, favorable frequency response, and high-efficiency capabilities. The design utilizes copper tubing and copper foil to minimize high-frequency losses and system weight, alongside specialized nanocrystalline sheets to suppress electromagnetic interference (EMI) and enhance magnetic coupling. An LCC-SSS resonant converter, also operating at 1 MHz, delivers over 600W through inductive coupling to an amplification coil, which subsequently transfers power to the load coil and drone charging circuitry. Additionally, nonlinear capacitive circuits are explored for their potential to optimize efficiency under variable distances and orientations. Circuit and physics simulations are validated against empirical measurements of efficiency, output power, and transfer distance through prototyping efforts. The results demonstrate the efficacy of high-frequency, three-coil architectures in providing efficient, extended-range power transfer for drone recharging applications.

Small Firms and Artificial Intelligence: Adoption, Barriers, and Implementation

Agrata Awasthi

Mentored by: Meenu Tewari

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Artificial intelligence (AI) is changing the way businesses operate. Evidence shows that by automating tasks, improving decision-making, and making workflows more efficient, many firms are increasing output growth and productivity. While AI has been widely adopted by large companies, small firms have a harder time with financial, technical, and organizational barriers that limit usage. Understanding how small businesses are using AI addresses an important gap in understanding technology adoption among businesses with limited resources. This study examines how small firms are using artificial intelligence, the factors that have influenced adoption, and the challenges that have affected successful implementation. This project uses a mixed-methods approach combining thematic literature review, analysis of secondary datasets, and key-informant interviews. Preliminary findings indicate that small businesses are increasingly using AI for marketing, customer service, and data analysis but still face barriers to broader adoption. Existing research shows that AI has improved efficiency and competitiveness but is often limited by financial costs, lack of technical expertise, cybersecurity concerns, and organizational challenges. By combining views from actual firms with secondary data analysis, this study provides a better understanding of how small businesses are using and adapting to AI and identifies the factors that support successful AI adoption and those that may limit or shape its adoption. The goal is to generate practical insights into how small businesses are navigating a period of significant technological change. These findings can help guide future research on AI's long-term effects on productivity and growth within small businesses.

Novel Synthesis Route for 2,7-dibromopyrene-4,5,9,10-tetraone and Exploring Routes for 2,7-diiodopyrene-4,5,9,10-tetraone and 1,2,3,6,7,8-hexaiodopyrene-4,5,9,10-tetraone

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2,7-dibromopyrene-4,5,9,10-tetraone (DBPT) is a key intermediate to making the organic frameworks for metal organic frameworks (MOFs). Currently in the literature, the most common way to create DBPT in the literature is using a procedure involving N-bromosuccinimide in a strong acid catalyst such as concentrated sulfuric acid. The downsides of such a procedure is that, based on the H NMR, there are impurities throughout the product due to the blocky organic group attached to the bromine. In this project, we present an alternative synthesis route using sodium bromate that leads to much higher purity, with no impurity peaks seen in the H NMR. The new synthesis route utilizes 4.5 equivalents of sodium bromate compared to pyrene tetraone in a 70/30 sulfuric acid/water mixture, heated to 30 degrees Celsius for two hours with constant stirring. After 2 hours the experiments were quenched with water, filtered using a centrifuge, and then dried in the oven. This procedure yielded pure DBPT with a yield of 24.69%. Furthermore, we present ventures into creating other key intermediates, including 2,7-diiodopyrene-4,5,9,10-tetraone (DIPT) and 1,2,3,6,7,8-hexaiodopyrene-4,5,9,10-tetraone (HIPT) for which synthesis routes are currently being explored. Challenges include characterization issues, particularly, for HIPT due to the lack of hydrogens in the final product leading to the use of C NMR.

The Effects of Systemic Racism in Education on STEM

Mina Azhar

Mentored by: N/A

North Carolina State University

This research examines how historical and structural racism within the U.S. educational system limits diversity in science, technology, engineering, and mathematics (STEM) fields, directly influencing the design and deployment of modern technical systems. Tracing educational policies from historic segregation practices to current funding disparities, this study highlights how resource gaps in majority-minority K-12 school districts restrict foundational STEM preparation. Consequently, marginalized populations face systemic barriers to entry and retention in engineering higher education and the professional workforce. Utilizing a qualitative literature review supported by secondary demographic and performance data, the paper evaluates the real-world consequences of underrepresentation in tech development, specifically focusing on algorithmic bias in facial recognition software and disproportionate impacts from mass surveillance technologies such as Automated License Plate Readers (ALPRs). The findings demonstrate that lacking diverse perspectives in engineering allows implicit biases and systemic inequities to become embedded in digital infrastructure. To address these challenges, this poster outlines actionable recommendations.

Heritage Language Maintenance and Cultural Preservation Among Second-Generation Indian Immigrants in the United States

Aditi Babar

Mentored by: Paloma Fernandez Sanchez

University of North Carolina at Charlotte

Heritage languages play a role in shaping cultural identity, maintaining family connections, and fostering a sense of community among second-generation immigrants. The Indian American community is linguistically diverse, with Hindi, Gujarati, and Bengali among the most widely spoken Indian languages in the United States. However, for second-generation Indian immigrants, maintaining heritage languages can be challenging as English is dominant across educational and professional settings. This literature review examines the role of heritage language maintenance in shaping cultural identity and belonging among second-generation Indian immigrants and considers how family, community, religious institutions, and educational environments support or hinder language maintenance. This review draws on linguistics (Tesser et al., 2001; LaDousa et al., 2022), sociology (Alba et al., 2002; Dhingra, 2007), education (Kumar et al., 2022; Reid, 2001), and diaspora studies (Samarth, 2013; Prasad, 2026) to examine heritage language, identity, community influence, and pressures favoring English.Three themes emerged from the literature: heritage language can strengthen cultural identity and intergenerational connections; families, peers, and communities play an important role in maintaining language use; and pressures favoring English can contribute to heritage language loss. The literature also identifies additive bilingualism and translanguaging as approaches that can support English development and heritage language maintenance. These findings suggest that heritage language preservation requires support across families, communities, and educational settings. This review highlights the relationship between language, identity, and cultural belonging within the U.S. Indian diaspora and provides strategies that support heritage language maintenance and cultural continuity across generations.

Exploring The Effects of Salinity Induced Osmotic Stress on Seed Germination and Early Seedling Development

Sreeya Bade

Mentored by: Jennifer Williams

North Carolina School of Science and Mathematics

Salinity can affect plant growth by altering water availability and creating osmotic stress. I investigated how ocean salinity affects seed germination by watering seeds with salt water to simulate ocean conditions. I hypothesized that higher salinity would decrease seed germination because it lowers water potential and makes water less available for the seed to take up. Fifteen Alaskan pea seeds were divided among 3 treatments: 0%, 1.75%, and 3.5% salinity, corresponding to freshwater, brackish water, and seawater. Each treatment contained 5 seeds. Constant variables included seed type, seed number in each petri dish, and temperature. The control was the 0% salinity treatment. I recorded germination rate and changes daily until no more growth would occur. That took 4 days. By Day 2, all five seeds in the 0% salinity treatment had germinated and remained at 100% through Day 4, while no seeds in saline treatment had germinated. Freshwater seeds developed longer roots. These findings indicate that increased salinity inhibited germination, supporting the hypothesis that salinity-induced osmotic stress can limit water uptake required for germination. Water moves by osmosis from areas of high to low water potential, so in salty water, less water enters the seed, slowing germination. This information is useful for farmers and scientists. Farmers in areas with salty soil can choose salt-tolerant crops or reduce soil salt through drainage, while scientists restoring land can select plants suited for salty environments. Understanding how salinity affects water movement is crucial for making better choices when growing plants in salty conditions.

Curating and Visualizing Environmental Pesticide Exposure Compounds from Public Metabolomics Data

Faith Bailey

Mentored by: Collyn Gaffney

North Carolina School of Science and Mathematics

When pesticides are used in homes, agriculture and industry where does one go in a pesticide world? Pesticides can enter the human body through various methods such as food, water, air, and skin contact leading to a wide range of human health issues from acute poisoning to chronic illnesses like cancer. The goal of this project is to curate, organize, and visualize pesticide related compounds that can be detected in human blood or urine using public metabolomics data and python. This is because databases are organized in the way that represent data poorly making it harder for researchers and for concerned citizens to have access to valuable information.By creating lists of pesticides through NHANES, PubChem, EPA CompTox Databases and using the list to extract certain identifiers through coding later being used to code for visualizations. Visualizations that could better convey what the pesticides are, how they are used, and the impact of usage for researchers to have readily available information.

Belief and Blackness.

Faith Bailey

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Commonly in Black American households it is instilled to praise, pray, worship and idolize the Christian God? It is a key factor within their home, families, and a belief setter within themselves but why? Why for generations have Blackness and Christianity been commonalities with each other and when does faith become a recipe for shared sanctuary but racial neglect. This is a study aims to explore the three key concepts involving Black Christianity: isolation, history and unity. Through exploring Black Manifesto, the rise of Black agnostic, Church -vs- other common Black meeting places (ex. Family cookouts), excerpts of the movie Sinners. The goal of the research is to explore how the church became a connection for Black people and also a divider in the community for Black agnostics/ atheists that choose not to participate. The study is rooted in Black identity and the cross over with faith more specifically the christian God. Critiquing its placement and relevance in the 20th century and the shift in practices.

The Orientalist Logic of US Policy Toward Iran

Siddhartha Bajpai

Mentored by: Tatiana McInnis

North Carolina School of Science and Mathematics

This paper relies on and expands Edward Said's Orientalist framework and Achille Mbembe's necropolitics to argue that a neo-colonialist ideology embedded in the US political system seeks to maintain control and supremacy over the Middle East. By analyzing US government rhetoric, Iranian first-person accounts, survey data, and media coverage, I argue that by labeling Iran as a state sponsor of terrorism and intensifying sanctions over time, the US has mobilized the American people against Iranian citizens, instead of targeting specialized sectors to curb Iran's nuclear efforts. US policy towards Iran is best understood as an expression of a need to construct Iran as an irrational, dangerous "Other" over which the West must maintain authority. To Western interests, Middle Eastern countries that emulate the power hunger of the West are perpetually a threat, and Western countries use neo-warfare to maintain their supremacy. This is independent of outcomes: although sanctions and economic warfare against Iran have not succeeded in drastic regime change, they persist. The 2026 US-Iran war has further exacerbated this ideology, as its justification relies on conflating the Iranian state with the Iranian people, constructing both economic devastation and mass death as acceptable means to an end. By fully understanding US motivations, this paper seeks to contextualize the ongoing war in Iran within a longer history of US-Middle Eastern conflict.

Food Literacy Measurement Review: Findings to Guide Tool Development for Population with Lower-Incomes

Samuel Baker

Mentored by: Brandon Stroud

East Carolina University

Food literacy encompasses the knowledge, skills, behaviors, and confidence individuals use to plan, select, prepare, and consume food. Although food literacy is increasingly recognized as an important influence on dietary behaviors and health, existing assessment tools vary considerably in how the concept is defined and measured and may not adequately reflect the resource constraints experienced by adults with lower incomes. This scoping review aimed to identify and synthesize existing food literacy assessment tools, the domains they measure, their psychometric evidence, and their applications across populations and settings. A systematic search identified 13,230 records, of which 317 full-text articles were assessed and 73 studies that developed, validated, or applied a food literacy measure were included. Preliminary findings demonstrate substantial heterogeneity across existing measures. Seven recurring or adapted tool families appeared across 32 articles, while measures varied considerably in their content, length, intended populations, and supporting evidence for reliability and validity. Frequently assessed domains included food preparation, meal planning, label reading, decision making, shopping, nutrition knowledge, and budgeting. Importantly, only nine of the 73 included studies specifically targeted lower-income, low-socioeconomic-status, or socially disadvantaged populations. Existing measures may therefore overlook financial, environmental, and social constraints that shape everyday food decisions for adults with lower incomes. These findings identify important gaps in the current measurement landscape and will guide refinement of food literacy domains and questionnaire items, supporting development of a relevant, comprehensive, and psychometrically sound assessment tool that better reflects the experiences of adults with lower incomes.

Localized White-matter Tractography and Structural Integrity Correlations with Physiological/ Psychological Stress

Aiden Balandan

Mentored by: Rosie Dutt

University of North Carolina at Chapel Hill

Stress-related physiology involves communication between regulatory and emotional regions in the brain. Therefore, understanding how differences in stress-related activation are associated with microstructure may provide insight into neural pathways related to clinical symptoms, and existing psychiatric neuroimaging literature demonstrates a need for structural specificity with clinical symptoms as potential biomarkers for intervention. Diffusion Weighted Imaging (DWI) tractometry collected from the MPI-Leipzig Mind-Brain-Body dataset will be used to evaluate white-matter microstructure for further correlations with physiological and psychological stress markers. While conventional DWI analyzes either voxel or whole-tract metrics, automated fiber quantification (pyAFQ) specifies major white-matter bundles and derives fractional anisotropy (FA) and mean diffusivity (MD) metrics along the reconstructed pathway at 100 nodes. This approach allows for localized associations along individual tracts to potentially observe regions with relationships to stress measures. After correlational tract analysis, machine-learning models will be developed to predict stress-related measures from bundle microstructure. Therefore, the present analyses can describe localized, tract-specific white-matter bundle correlations with autonomic and psychiatric stress metrics to enhance anatomical specificity in implicated neural pathways.

Mind Shift

Natalee Balestra

Mentored by: Christine Stevens

High Point University

Mind Shift explores how shifting one's mindset and overcoming fear can unlock passion. Drawing on my personal journey—from initially seeing a career in the arts as unrealistic to choosing dance—this project examines how self-doubt, fear, encouragement, and personal resolve shape our decisions. Informed by research on creativity, growth, and self-efficacy, it emphasizes that our perception of our abilities shapes our willingness to take risks and pursue meaningful goals. Through contemporary movement, contrasting dynamics, spatial patterns, and energy shifts, the choreography visually depicts the journey from feeling restricted and uncertain to experiencing freedom, confidence, and possibility. The process involved creating movement motifs that symbolize internal conflicts and gradually transforming them to reflect a shift in perspective, demonstrating how movement can express an inner psychological journey without words. Ultimately, Mind Shift shows that altering how we view ourselves and our potential can foster growth and motivate us to follow personally meaningful paths. The work also contributes to dance research by illustrating how personal experience can become an embodied exploration of mindset and self-discovery.

Analyzing the Relationship Between Soil Oomycetes and Fungal Community Makeup Following Fungicide Application in the Warren Wilson American Chestnut Orchard

Anathea Ball

Mentored by: Eric Griffin

Warren Wilson College

The American Chestnut, Castanea dentata, is a culturally and ecologically important species that once comprised a quarter of the biomass in Eastern deciduous forests. In the early 20th century, an invasive blight-causing fungus, Cryphonectria parasitica, was introduced to the United States through the timber trade and killed nearly four billion trees in under four decades. Another pathogen named Phytophthora cinnamomi, is a soil oomycete, and is a less discussed but very impactful species that causes additional harm to C. dentata. This root rot, which kills feeder roots, forms trunk cankers, and often kills host trees, may disrupt the future restoration potential of C. dentata trees. Comparatively little is known regarding the interaction of soil oomycetes with fungal communities, which may shed light on the potential benefits of healthy soil fungal microbiomes in forest ecosystems. My project incorporates analysis of Phytophthora presence with ongoing C. dentata restoration efforts at the Warren Wilson College Chestnut Orchard in Swannanoa, NC. I isolated DNA from soil samples at the base of 35 C. dentata seedlings, and sequenced those soil samples for both oomycete and fungal communities. Overall, particular fungal taxa were associated with the presence or absence of oomycete taxa, suggesting dynamic interactions between the two. Further work is needed to shed additional light on the intricate interactions among soil microbiomes, which may help in future forest restoration efforts.

Demonstration of Schottky-Source β-Ga2O3 Vertical Static Induction Transistor by TCAD

Seunghyeon Bang

Mentored by: Saurav Roy

North Carolina State University

Static Induction Transistor (SIT) has demonstrated high voltage and frequency due to its very short length between the gate and source to reduce the channel resistance. However, conventional SITs rely on a p-n junction or deeply recessed gate to pinch off a narrow channel, requiring either p-type doping or deep etching which adds process complexity and reliability concerns. In this work, a novel Schottky source vertical β-Ga2O3 SIT is investigated using TCAD simulation. The device uses a source Schottky contact instead of conventional ohmic contact, enabling the source contact to operate as a Schottky barrier diode in the off-state. The metal oxide semiconductor (MOS) gate overlaps the source contact, and the applied gate voltage controls the tunneling thickness of the schottky barrier to inject electrons into the semiconductor through thermionic field emission. Gate-source overlap length is varied to study the effect on the current flow and device characteristics. The output, transfer, and electric field distribution are studied under different parameters. The proposed β-Ga2O3 SIT exhibits an unsaturated SIT-like output characteristic with a high current density of approximately 13 kA/cm2 at VDS = 6 V and VGS = 20 V. In addition, the device achieves a low specific on-resistance of 0.407 mΩ·cm2 and a high Ion/Ioff ratio exceeding 108. These results demonstrate the potential of Schottky-source vertical SIT architectures which circumvents the need for scaled lithography and the lack of shallow acceptors for β-Ga2O3 vertical transistors. Thus this study paves the way for the next generation of high-power/high-frequency electronics.

Assessment of Demolition-Related PM2.5 Exposure and Chemical Composition in an Environmental Justice Community

Donovan Banks

Mentored by: Richmond Bryant

North Carolina Central University

Following decades of industrial activity at the Alcoa-Badin Works aluminum smelting facility, demolition of the site began in April 2025, raising concerns among predominantly Black West Badin residents about airborne contaminant exposure. In response, the Concerned Citizens of the West Badin Community partnered with the North Carolina Environmental Justice Network, NCSU, and CleanAireNC to conduct community-led air quality monitoring during demolition. Fine particulate matter (PM2.5) was monitored from April-August, 2025 at a site in West Badin and background (Albemarle) using Ultrasonic Personal Aerosol Samplers (UPAS), which provided real-time PM2.5 measurements and collected PM2.5 on filters for chemical characterization. Scanning Electron Microscopy–Energy Dispersive X-ray Spectroscopy was used to identify elemental constituents associated with demolition-related emissions. Results indicated that PM2.5 concentrations in West Badin exhibited frequent short-term spikes during demolition, with concentrations exceeding U.S. Environmental Protection Agency thresholds for sensitive groups substantially more often than at the comparison site. Elemental analysis revealed elevated concentrations of fluorine and carbon. This study demonstrates how citizen-driven partnerships can provide critical scientific evidence to support environmental justice advocacy and inform future remediation, monitoring, and public health protection strategies in historically marginalized communities.

Mapping the Loss of Hayti: Redlining, Redevelopment, and Black Community Life in Durham

Max Bao-Dai

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This project examines how redlining and the Hayti-Elizabeth Urban Renewal Project transformed Hayti, Durham, from a thriving Black residential and business district into a site of displacement, redevelopment, and cultural memory. Built after emancipation, Hayti became one of Durham's most prominent self-sustaining Black neighborhoods, with homes, churches, schools, and businesses that supported Black life under Jim Crow. Drawing on Leslie Brown's Upbuilding Black Durham, this research first contextualizes Hayti within the larger history of Black upbuilding in Durham, especially around Fayetteville and Pettigrew Streets, where more than 100 businesses and 600 homes once made up the center of Hayti. The project then analyzes how official maps and documents helped reclassify Hayti. Using the University of Richmond's Mapping Inequality project, Duke University's Hayti-Elizabeth Street Renewal Area maps, DigitalNC's Durham Urban Renewal records, Bull City 150, and municipal records from Durham Mayor E.J. Evans, this project argues that redlining and urban renewal worked in sequence. Redlining marked Black neighborhoods as undesirable and risky investments, while urban renewal later used the language of blight to justify demolishing Hayti. More than 4,000 households and 500 businesses were razed across Durham, and the Durham Freeway physically divided the neighborhood. Yet initial Black support for urban renewal complicates this history, as residents were promised long-denied housing and investment. Ultimately, this project argues that Hayti's demise began in the ways officials mapped, reclassified, and targeted a thriving Black community. Yet Hayti also survives through cultural memory, especially through the Hayti Heritage Center and archival recovery.

The Effects of Plant Extracts on the Growth of Strepptococcus Pneumoniae

Moorea Barbee

Mentored by: Tahl Zimmerman

High Point University

Streptococcus Pneumoniae is a bacterium that causes mild infections and severe diseases like pneumonia. The bacterium is growing increasingly resistant to antibiotics. The goal of this project is to discover an antimicrobial for S. Pneumoniae that derives from peppermint (Mentha Piperita). Polyphenols are compounds with antimicrobial properties found in many plant products including peppermint. Our hypothesis is that peppermint extract has polyphenols with antimicrobial activity that will prevent or slow the growth of S. Pneumoniae.To investigate the effects of peppermint plants on the growth of S. Pneumoniae, tea extracts were prepared by pouring boiled distilled water onto crushed peppermint leaves. Varying tea and water ratios were tested for extraction potential and optimal extraction polyphenols using a microplate reader on 280 (for total polyphenols), 320(for flavones), 360(for phenolic acid), and 520(for total anthokyanids) nm wavelengths. Then the growth of bacteria with peppermint was be compared to the bacteria culture as determined by the OD levels at 750nm, 600nm, and 500nm. When the growth of S.Pneumoniae in the presence of Peppermint was compared to the S.Pnuemoniae alone, the growth curve with peppermint stayed at an OD of zero while the S.Pneumoinae alone had a steep growth curve. Additionally, dilution tests were done to find the minimum inhibitory concentration of Peppermint. After the Peppermint was diluted 2 times it still completely inhibited the growth of S.Pnuemoniae. When the specific compound that slows the growth of the bacteria is identified, we can start to understand pneumonia and better ways to treat it.

Creativity in Policing

Emma Barker

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

The Charlotte-Mecklenburg Police Department (CMPD) serves Charlotte by adopting creative policing innovations and implementing them locally. The literature indicates that police use creativity in technology, community interactions, and historical events responses. This project is important because the responsibility of the police is to keep their community safe, which includes most, if not all, United States residents. My inquiry question is: How is creativity shown in adapting policing innovations to the local area? To answer my inquiry question, I examined literature showcasing elements of police creativity. To observe creativity in the real world, I will go into Uptown Charlotte to observe how police visibility is handled locally. This project is still in progress; however, I anticipate that the answer to my inquiry question will likely be that, in order to adapt policing innovations to the local area, police must know the demographics of their community, follow local laws, and speak with community members. In conclusion, the results of this project will be especially useful for both community members and police officers. Community members desire to be safe and see accountability and transparency from the police. By inspiring creativity in the police, improved practices can be formed to benefit safety. Additionally, by seeing how police form policies, programs, and innovations creatively, the community can hold the police accountable for their process and clearly see where practices originate. Police themselves can see the methods in which creative policing innovations are formed and adapt preexisting innovations to keep their community safe.

Investigating the Relationship Between Molecular Properties, Blood-Brain Barrier Permeability, and ADHD Medication Effectiveness

Immerya Barr

Mentored by: Rebecca Guth-Metzler

Queens University of Charlotte

Attention-deficit/hyperactivity disorder (ADHD) medications differ in their chemical structures and pharmacokinetic properties, which may influence how they reach the brain and produce therapeutic effects. Previous research has examined the blood-brain barrier permeability, duration of action, and effectiveness of individual ADHD medications, but comparing these factors across different medications may provide additional insight into how medication properties relate to treatment outcomes. This project aims to determine whether molecular properties and predicted absorption, distribution, metabolism, excretion, and toxicity (ADMET) characteristics of selected ADHD medications and their active components can be used to predict blood-brain barrier permeability, treatment duration, and medication effectiveness. Six medications will be examined: methylphenidate, amphetamine, lisdexamfetamine, dexmethylphenidate, clonidine, and guanfacine. Molecular properties will be collected from PubChem, while predicted ADMET characteristics, including LogD at pH 7.4, blood-brain barrier prediction, P-glycoprotein interactions, plasma protein binding, volume of distribution, plasma clearance, and half-life, will be obtained using ADMETlab 3.0. Scientific literature will be used to collect information on blood-brain barrier permeability, treatment duration, and effectiveness. This data will be analyzed using descriptive statistics, correlations, and graphical comparisons. Differences in molecular and pharmacokinetic properties are expected to correspond with differences in predicted and reported blood-brain barrier permeability, treatment duration, and effectiveness. This study may help to clarify how the chemistry and pharmacokinetic properties of ADHD medications relate to their ability to reach the brain and their clinical effects.

The Evolution of Women's Rights in Afghanistan

Thanushri Baskar

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

When the minority silences the majority, when will the rest of the world speak up for the silenced? Around the world, women's rights are rapidly degrading. Authoritarian figures and their governmental bodies have yet to be held accountable as they collectively pave the way for violence and repression against women to continue. Women in Afghanistan received the right to vote in 1919, beginning one of the earliest countries on record to announce that women and men are equal. Yet today, they live under the authoritarian regime of the Taliban, which has systematically stripped Afghani women and girls of their fundamental human rights. This study explores first-person accounts, the work of field researchers, news articles, the Afghanistan Law catalog, documentaries, and Afghani art. By analyzing these works, the impact of Women in Afghanistan, their lives today, how it was before the Taliban rule, and how the resistance continues will be highlighted.

Beyond a Reasonable Doubt: The Evolution, Application, and Evaluation of the Standard in Criminal Jury Decision-Making

Abbey Beam

Mentored by: Tiffany Berzins

University of North Carolina at Charlotte

Proof beyond a reasonable doubt (BARD) sits at the center of the criminal justice system as its highest standard of proof, separating conviction from acquittal in jury trials. Established as a constitutional safeguard against wrongful conviction, BARD requires jurors to reach a high degree of certainty that a defendant is guilty through their evaluation of the evidence. However, a standard that originated in medieval moral anxieties about condemning the innocent and was later recognized as a due process requirement has never acquired a universally accepted definition. Jurors are expected to make consequential decisions of guilt and innocence with limited guidance for interpreting the standard, producing variability in its application. This literature review examines how jurors interpret and apply BARD through psychological decision-making and uses these findings to inform a six-session seminar for first-year Honors students. Integrating legal scholarship with research on juries and psychology, the review analyzes the story model, dual-process theory, the elaboration likelihood model, cognitive bias, emotion, and group deliberation. The literature indicates that jurors presented with the same evidence may differ in the amount of evidence they consider sufficient, the types of evidence they find persuasive, and the level of uncertainty they accept before reaching a verdict. Rather than functioning as a fixed threshold, BARD operates as a dynamic psychological process shaped by narrative construction, individual biases, cognitive processes, and group deliberation. These findings reveal a tension between the justice system's reliance on BARD to produce consistent outcomes and the inherent variability of human decision-making under uncertainty.

Surface characterization of silver-modified resin dental composites

Samantha Bean

Mentored by: Luis Fernandez-Torres

Catawba College

Silver nanoparticles (AgNPs) possess broad-spectrum antimicrobial activity, which makes them suitable as coatings to inhibit biofilm growth. AgNPs have been proposed as an additive to resin dental composites, which are a class of direct restorations, due to their antimicrobial properties. Previous research studied the bactericidal action of AgNPs incorporated into dental resins. However, there is a lack of studies on how added nanoparticles affect surface morphology. Furthermore, resin dental composites, most of which are photocurable, often contain methacrylate monomers and bisphenol A, molecules known to be cytotoxic, genotoxic, and mutagenic. This study presents the preparation of AgNPs-modified resin dental composites and their surface morphology characterization using scanning electron microscopy (SEM). The study also describes how exposure to different pH values and exposure periods affect the modified composite's surface. pH values, consistent with common food products, and exposure periods were selected to closely resemble the dental composite's expected use. It is hypothesized that addition of AgNPs has no adverse effect on surface morphology, and that prolonged exposure to low pH values can alter surface morphology. The results presented in this study are analyzed in terms of observed surface features (such as indentations and color), and their implications on composite durability, and safety. Further work will explore how the addition of AgNPs could affect the formation of biofilms on the composites.

How does habitat structure mediate the relationship between anthropogenic noise and mammal species richness in an urban forest?

Sara Behnam

Mentored by: Sara Gagne

University of North Carolina at Charlotte

Urbanization alters wildlife habitats by changing vegetation structure, increasing human activity, and introducing anthropogenic noise. Road noise can disrupt mammal behavior, movement, and habitat use in urban forests. However, the relationships among anthropogenic noise, habitat structure, and mammal diversity remain uncertain. This research investigates how habitat structure mediates the relationship between anthropogenic noise and mammal species richness in two different urban forests in Mecklenburg County, North Carolina, USA, while contributing to Snapshot USA, a nationwide wildlife camera-trapping project. Local data from this study will be compared with nationwide Snapshot USA data to better understand patterns of mammal diversity across different environments. We predict that areas with greater habitat complexity may support more mammal species despite higher levels of anthropogenic noise. 16 motion-sensitive infrared camera traps at varying distances from roads and each other to document mammal species occurrence and diversity at each camera array. Cameras were mounted on trees approximately knee height and oriented parallel to the slope. The cameras were active since September 4th following the Snapshot USA sampling period of September 1 through October 31. The number of detections/photos per sampling period and Google Earth will use mammal detection rate as the response variable and measure road density surrounding each camera array as a measure of anthropogenic noise. Using both local camera-trap data and the nationwide Snapshot USA dataset. I will then use general linear models to test how the interaction between habitat type and road density affects mammal detection rate.

Design and Testing of Simultaneous Ozone Suppression and Thrust Enhancement of Dielectric Barrier Discharge Plasma Actuators using Ultraviolet Light

Baya Belgaied

Mentored by: Michael Falvo

North Carolina School of Science and Mathematics

Dielectric barrier discharge (DBD) plasma actuators are small devices that weakly ionize air to produce ionic wind. They are being studied for aerospace applications due to their potential of drag and noise reduction on aircraft, while being lightweight, having no moving parts, and requiring a relatively low power consumption. However, the barriers to using DBD plasma actuators, specifically those powered by high AC voltages at high frequencies, include the amount of ozone produced to the surrounding air. I tested the hypothesis that applying ultraviolet (UV) - C light with a wavelength of 254 nanometers can simultaneously reduce ozone production and increase the net thrust of the actuators when powered with AC sinusoidal voltage. The power supply used was an AC flyback transformer connected to a DC power source to create sufficient AC voltage and frequency values for consistent actuator trials. Thrust tests were performed using an electronic milligram scale with the actuator pointing upward and an ozone monitor in close proximity to measure local ozone concentrations over time. The results from these studies have implications for future research regarding the use of DBD plasma actuators and their usefulness in actual aircraft, aiding in making aviation safer and more sustainable.

Biomechanical Sustainability in Computer Use and Instrumental Performance

Jacob Bell

Mentored by: Matin Yarmand

University of North Carolina at Charlotte

The increasing specialization of modern academic and professional environments has produced a growing number of students in fields that demand high-volume use of fine motor skills, such as intensive musical performance and high-volume computer work. However, while high rates of performance-related musculoskeletal disorders are well documented among musicians and computer users independently, the cumulative biomechanical consequences of participating in multiple high-intensity manual domains remain insufficiently explored. The goal of this research project is to investigate these overlapping physical demands by conducting a comprehensive literature review synthesizing research across performing arts medicine and occupational ergonomics. Research supports that injury development is driven less by discipline-specific hazards and more by shared mechanical exposure patterns, such as high-volume repetitive motion, sustained neuromuscular activation, and constrained joint positioning. These findings suggest that career sustainability depends on integrated approaches combining ergonomic design implementation, movement variability, and structured rest. Ultimately, this project provides students pursuing fields involving computing as well as instrumental performance with an understanding of the need for ergonomically tailored equipment, recovery strategies, and the consequences of maladaptive working habits on career longevity.

Design and 3D Printing of Smartwatch and Display Housings for GRID-AIR

Iris Bellamy, Joshua Jones

Mentored by: Morteza Nazari Heris

East Carolina University

Drone-based inspection of electrical infrastructure requires interfaces that protect electronic components and provide accessible feedback to operators. This project focuses on designing and fabricating custom housings for a smartwatch and a portable touchscreen display within GRID-AIR, a drone-based infrastructure inspection platform. The broader system is intended to use artificial intelligence to analyze thermal images collected by a DJI S1000 drone equipped with a thermal camera. Two ESP32 microcontrollers support the sensing and wearable interface: one connects to a drone-mounted magnetometer, while the other operates a CrowPanel smartwatch display. The wearable device is intended to provide vibration alerts based on magnetic-field measurements, subject to calibration and validation. A Raspberry Pi 5 paired with a seven-inch touchscreen is intended to support image analysis and display inspection feedback. Our contribution centers on the mechanical design of enclosures that accommodate these components while supporting protection, wearability, and ease of use. Housing models are being developed in SolidWorks, and prototypes are being fabricated using polylactic acid (PLA) through 3D printing. The smartwatch housing prioritizes comfortable wear and access to the interface, while the display housing is intended to protect the screen and associated electronics during handling. This ongoing work aims to provide practical enclosures that support integration and subsequent evaluation of the GRID-AIR operator interfaces.

Comparing Parents' Perceptions on Children's Learning Across Two Shared Reading Contexts

Bouchra Benzit

Mentored by: Kathryn Leech

University of North Carolina at Chapel Hill

Bouchra Benzit, Dorentina Dedushaj, Kathryn LeechScience, Technology, Engineering, and Mathematics (STEM) plays a central role in modern life and society. However, classrooms are typically allocated limited instructional time for science (Habar and Kumar, 2025). In this study, three books were read during shared-reading sessions from families of diverse backgrounds. A total of 81 families were randomly assigned one of two conditions: high science (HSP) and low science (LSP). While books were the same, HSP books were embedded with Next Generation Science Standard (NGSS) codes, and the LSP books contained no NGSS codes. This study focused on parent interviews based on questions asked about how their children's behavior has changed from the shared readings. Responses were coded and placed into at least one of three categories: socio-emotional evidence, scientific evidence, and no evidence. Parents in the HSP condition reported that their children incorporate more science in their life compared to the no coding group. With this, we hope to add books with more science content in school libraries for children to become familiar with what science entails. Incorporating shared reading practices at home and in the classrooms may aid in sustaining interest and engagement with science throughout children's schooling and into adult life.

Phenotypic and molecular characterization of six geminiviruses infecting tomato lanai.

Sela Bettoli, Sophie Anikow

Mentored by: Trino Ascencio-Ibáñez

North Carolina State University

Geminiviruses are plant pathogens that cause significant changes in plant growth, development, and general host response. This study aims to compare how different geminiviruses affect gene expression in tomato host plants and how these molecular changes relate to symptom development. Tomato Lanai plants will be inoculated with one of six geminiviruses via biolistics or agroinoculation. Plant growth will be monitored by measuring height, taken at 7-day intervals from time of inoculation. Disease symptoms will be evaluated using a 1-to-5 severity scale. Oxford Nanopore long-read sequencing will be used to characterize changes in host gene expression at 21 dpi and identify patterns of upregulation and downregulation associated with each virus. Viral tissue tropism will be investigated through in situ hybridization and ploidy state by flow cytometry. For in situ hybridization, vibratome sectioning and light microscopy will be used to determine the distribution and localization of viruses within leaf tissues. Together, phenotypic measurements, transcriptomics, ploidy data, and tissue localization will provide a comprehensive comparison of how different geminiviruses interact with tomato plants. We expect each virus to produce distinct patterns of symptom development and host gene expression, with differences in disease severity, persistence, and recovery. Identifying the tissues in which viruses preferentially accumulate may further clarify how viral localization contributes to disease progression and plant responses.

Evaluation of Dried Blood Spot Samples for Molecular Detection of Canine Vector-Borne Pathogens

Purvi Bhagat

Mentored by: Barbara Qurollo

North Carolina School of Science and Math

Canine vector-borne diseases (CVD) are an important cause of illness in dogs and require accurate laboratory testing for diagnosis and treatment. Molecular methods such as PCR are commonly performed using whole blood samples, but these samples require refrigeration and can be expensive to store and transport. Dried blood spot samples (DBS) samples use only a small volume of blood applied to filter paper, making them easier to store and transport than whole blood (WB). This project investigated whether DBS samples can provide molecular test results comparable to WB samples for detecting canine-vector borne pathogens. DNA was extracted from 22 paired WB and DBS samples previously collected from dogs for CVD testing and known to be qPCR+ for either Ehrlichia canis or Babesia gibsoni. qPCR was retrospectively performed on each set of DNA samples to test for B. gibsoni and E. canis . Ct values from WB and DBS samples were compared using Pearson correlation, linear regression, Wilcoxon signed-rank testing, and Bland-Altman analysis to evaluate the agreement. Preliminary results showed strong agreement between DBS and WB for the Babesia LSU4 assay. For the Anaplasma/Ehrlichia 16S assay, agreement was lower because 4 DBS samples did not produce detectable Ct values, possibly reflecting a difference in the target organisms or lower number of white blood cells present in DBS samples. Overall, the results support DBS as a practical alternative for molecular diagnosis. This approach may improve diagnostic accessibility and disease surveillance, particularly in remote or resource-limited settings.

Attenuating Developmental Delays with Bacopa monnieri Extract in a Drosophila melanogaster Model of Fragile X Syndrome

Anshita Bhunia

Mentored by: Jennifer Williams

North Carolina School of Science and Mathematics

This project investigates how Bacopa monnieri (B. monnieri) extract affects cognitive function in a Drosophila melanogaster model of Fragile X Syndrome (FXS). FXS is an inherited genetic disorder that results from loss of FMRP(Fragile X messenger ribonucleoprotein), disrupting pathways involved in neuronal development, synaptic function, and neuroinflammation. B. monnieri contains bacosides with reported neuroprotective, anti-inflammatory, and cognitive effects, including effects on cholinergic signaling and acetylcholinesterase (AChE). To evaluate these effects, feeding assays were conducted to confirm comparable food consumption across treatment groups, pupation kinetics to assess developmental progression, larval associative learning assays to measure cognitive function, and negative geotaxis assays to assess locomotor performance. AChE activity was measured using a colorimetric Ellman assay of fly-head extracts. Preliminary results showed no meaningful differences in feeding across treatment groups, with treated flies expected to demonstrate improvements across developmental, cognitive, locomotor, and biochemical measures, including earlier pupation, improved associative learning and climbing performance, and decreased AChE activity. Together, these findings may suggest that B. monnieri influences multiple pathways associated with neurological function in FXS. This research explores a potentially accessible neuroprotective intervention and contributes to understanding how a natural compound may affect behavioral and biochemical phenotypes associated with neurodevelopment disorders.

Differences in Veteran vs. Civilian Bodily Response to Solfeggio Frequencies

Skylar Bledsoe

Mentored by: Tennille D. Presley

Johnson C. Smith University

Differences in Veteran vs. Civilian Bodily Response to Solfeggio Frequencies Skylar Bledsoe1, Tennille D. Presley, PhD2, 3The DataSmiths Initiative, College of STEM, Johnson C. Smith University, Charlotte, North Carolina, USA1; Biomedical Research Infrastructure Center2, Department of Chemistry and Physics3, Winston-Salem State University, Winston-Salem, North Carolina, USA. Solfeggio frequencies have been associated with potential physical and psychological benefits, but limited research has examined how individuals from different populations respond to these frequencies. This study explored physiological responses to six pure-tone Solfeggio frequencies in civilian and veteran participants. Nineteen participants (10 civilians and 9 veterans) were exposed to six frequencies while blood pressure and skin conductance were measured. Participants also completed a survey that collected demographic information, identified participant groups, and assessed emotional state and relevant personal experiences. All nine veteran participants self-reported a history of post-traumatic stress disorder (PTSD). Data were examined to explore differences in physiological responses between the two groups. Civilian participants demonstrated a higher average skin conductance response (11.93 ± SD μS) than veteran participants (2.416 ± SD μS) when exposed to the same frequencies, representing a 132.6% difference between the groups. Survey responses also indicated changes in reported emotional state following exposure, with 7 veterans reporting feelings of either joy or content, and 8 civilians expressing the same emotional response. The presence of self-reported PTSD among the veteran participants provides important context for interpreting the observed differences, although this study was not designed to determine whether PTSD contributed to differences in skin conductance. Future research with larger and more diverse samples should further examine physiological responses to Solfeggio frequencies while considering psychological and individual factors. This study provides preliminary data for understanding how individual characteristics may relate to physiological responses to sound-based stimuli.

Escapism for who? : an Analysis of Black Fan Art Discourse on X

Reggie Blue

Mentored by: E. Chebrolu

University of North Carolina at Chapel Hill

Fan art is a normal facet of anime and manga online fan communities, but what happens when artists transgress the norms of identity exploration in their art? Building on existing scholarship in fan studies, I analyze responses to X user Lynn6Thorex's fan art of Momo Ayase and Ken Takakura (Okarun) from the anime Dan Da Dan. I argue that Black fan art functions as visibility, belonging, and as an extension of Black fan practice - not an extension of racebending as activism. To understand the motivations behind Black fans participation in this discourse, I offer the term Black reimaginings as a framework in conversation with racebending to describe fan works that depict an existing non-black character as Black. Through a discourse analysis of responses to Lynn6Thorex's November 2024 Dan Da Dan fan art, I examine how fans engage with Black reimaginings as a way of building or denigrating Black fan communities.

Molecular Characterization of a Point Mutation on NHR25 Binding and Protein Expression

Francis. Boadu

Mentored by: Debbie Thurtle-Schmidt

Livingstone College

The nuclear hormone receptor NHR-25, a C. elegans ortholog of mammalian NR5A transcription factors, plays essential roles in development and gene regulation. This project investigated how a single amino acid point mutation in NHR-25 affects its DNA-binding activity and downstream transcriptional regulation. Western blotting was used to quantify NHR-25 protein abundance, providing insight into whether the mutation altered protein stability or expression levels and establishing a functional baseline for interpreting downstream genomic findings. In parallel, aCUT&RUN protocol was designed and optimized to profile genome-wide NHR-25 binding and identify mutation-dependent shifts in transcription factor occupancy at regulatory DNA elements. Existing gene expression datasets and heat maps were also interpreted to explore how altered NHR-25 activity may correlate with differential gene regulation. Future work will complete the CUT&RUN analysis to directly map NHR-25 binding across the genome and integrate these results with expression data to build a more complete picture of how this pointmutation disrupts transcription factor function and downstream gene regulatory networks.Together, this project strengthened skills in experimental design, molecular and genomic techniques, and multi-genomic data analysis.

Microwave Spectroscopy and Analysis of 2,3,4-Trifluorophenol

Hasinne Bonthu, Gandhimathi Sivarajan

Mentored by: Gordon Brown

South Carolina Governor's School for Science & Mathematics

In this research, we measured and analyzed the microwave spectrum of 2,3,4-trifluorophenol to analyze the shape of the molecule. Shape is an important feature of chemistry, as it typically determines the function of the molecule. We used microwave spectroscopy because it can measure the precise structure of a chemical by measuring the rotational transitions induced by the microwave radiation. The spectrum of 2,3,4-trifluorophenol was measured using chirped-pulse Fourier transform microwave spectroscopy over a frequency range of 8,000–18,000 MHz. Each measurement averaged over 10,000 scans to improve the signal-to-noise ratio. The rotational spectrum from the results was carefully analyzed by identifying and assigning spectral transitions. Gaussian 03W calculations were used to calculate the molecular spectrum as a calculated prediction. This was used to compare the predicted spectrum with the experimental spectrum. We then used the two spectra to determine the experimental spectroscopic constants which tells us the structure and flexibility of the chemical.

Evaluating the Anxiolytic Effects of N-Acetylcysteine in a Zebrafish Behavioral Model

Larissa Borg

Mentored by: Eric Bauer

Elon University

N-Acetylcysteine (NAC), traditionally used to treat acetaminophen overdose, has recently been studied for anxiolytic effects, likely through its antioxidant and anti-inflammatory properties. Clinical studies suggest NAC reduces anxiety mainly under chronic or extreme stress, yet depressive symptoms have also been reported at certain doses. This study asks whether NAC reduces anxiety-like behavior while producing depressive-like behavior in zebrafish (Danio rerio), a model sharing neurobiological and genetic similarities with humans. In a pilot novel tank test, NAC-treated fish spent significantly less time near the top of the tank than controls without a significant change in freezing, suggesting reduced exploration and depression rather than simple anxiety reduction. To test this, sixteen adult zebrafish were treated with 1 mg/L NAC for one week and compared with fifteen untreated controls in a 20-minute social preference test analyzed with EthoVision. Two-tailed t-tests showed that both control and NAC-treated fish spent significantly more time in the social zone than the asocial zone (both $p < 0.001$), and social zone time did not differ between groups ($p = 0.65$). Treated fish showed a nonsignificant trend toward the more social zone ($p = 0.069$). These preliminary results suggest NAC does not abolish social preference, which is often reduced in depressive-like states, although sample size is limited. Further analysis of NAC's behavioral effects may inform its safe use as a psychiatric intervention.

Exploring Visual Adaptions in Semi-Aquatic Snakes Using Hydrogel Based Optical Model

Daityn Bost

Mentored by: Bijay Shrestha

Catawba College

Semi-aquatic snakes such Nerodia sipedon and Thamnophis sp. often transition between aquatic and terrestrial environments, exposing their visual systems to different optical conditions that can affect their ability to focus. Previous research on snake vision has shown semi-aquatic snakes have demonstrated that pupil aperture can decrease during submersion to increase depth of field and compensate for underwater defocus. However, relatively little is known about how these adaptations work together in semi-aquatic snakes that must maintain functional vision both above and below water. In this project, we are developing an experimental set up and physical model to investigate optical characteristic of the semi aquatic snakes. As an initial approach, we are exploring the use of water absorbing polymer beads (orbeez) to construct simplified models that can reproduce selected optical properties of biological tissues and aquatic environments. No experimental results are available at this stage. Instead, the presentation will introduce the motivation, proposed hydrogel model, the experimental design, and question that will be guide the future investigations.

Childhood Onset Schizophrenia and the Factors that Lead to a Low Diagnostic Rate

David Boswell-Samuels

Mentored by: Jimmy Green

University of North Carolina at Charlotte

Childhood-onset schizophrenia (COS) is an extremely rare diagnosis, making up only 2% of schizophrenia cases, in spite of the relatively high prevalence of psychotic-like symptoms in children (18%). Research demonstrates that longer duration of untreated psychosis is associated with poorer functional and clinical outcomes. Further, age of onset in adulthood is associated with better clinical outcomes compared to onset in adolescence. This literature review seeks to explore the following research question, "What factors contribute to the low diagnostic prevalence rate of childhood onset schizophrenia?" This literature review explored this research question by searching PubMed, PsychInfo, and Google Scholar for research on COS. Articles relating to factors including general information about COS, COS case studies, and discussing parental and societal factors and stigmas were selected for review. The literature review suggests that the overall prevalence of COS may be underestimated due to provider factors including limited clinical training on COS, concerns about over prescription of antipsychotics, and diagnostic complexity. Further, parental factors may contribute to lower detection rates such as lack of mental health literacy and social stigmas. Improving provider and parental literacy of COS may increase diagnostic rates and access to care. Future research should explore interventions aimed at improving early detection of warning signs for COS for clinicians and parents.

French Policy and Foreign Affairs in Latin and Central America Under the Mitterrand Presidency During 1981

Lea Boyens

Mentored by: Jurgen Buchenau

University of North Carolina at Charlotte

President François Mitterrand was elected fourth president of France's Fifth Republic in 1981, bringing socialism to France. This research investigates French policy toward political and economic issues developing in Latin and Central America during Mitterrand's first year in office and how his stance was viewed internationally. Think of France as a queen on a chessboard, making moves on pawns: Mitterrand sought to position France alongside socialist Latin American leaders while also seeking economic interest for France. His game plan was the concept of Tiers-Mondisme, which emphasized connections between France and developing countries. Two parties central to Mitterrand's actions in 1981 were Mexico and Nicaragua's leftist Sandinista government. These relationships included providing arms to the Sandinista government during the Central American war against the Somoza dictatorship and signing the Franco-Mexican Declaration on El Salvador, promoting a political solution to prevent the region from turning into a larger battleground, where the United States had the region headed. Shortly after, tensions between France and the United States emerged during the North-South Summit in Cancun, where leaders were prohibited from discussing this matter and instead spoke on broader economic and political issues, such as inflation. Using primary sources from Mitterrand and Reagan, alongside contemporary regional newspapers, CIA documents, diplomatic correspondence, and government records, this study examines Mitterrand's motivation and these differing responses from France, Mexico, and the United States. Ultimately, it argues Mitterrand's Latin American involvement reflected concerns of regional instability and French diplomacy, creating a trade-off between alliances, national interests, and foreign affairs.

Mapping The Human Facial Microbiome. Investigating Spatial and Interindivdual Variations

Natalie Bradford, Francisco Camacho

Mentored by: Francisco Camacho

Catawba College

The human skin microbiome consists of diverse microorganisms that serve as the body's first line of defense against harmful bacteria. Understanding the skin microbiome is important because microbial composition can vary significantly between individuals and may include acne-associated bacteria influenced by both genetic and environmental factors. In this study, facial skin is mapped and sampled using a rough swab three times over a three-month period. DNA was extracted from the samples and bacteria 16S rDNA was sequenced to establish a baseline microbial profile of the skin. From the limited sampling bacteria communities from the same individual and same facial location showed a high degree of similarity.

Prebiotic Formation Kinetics of α,β, and γ Amino Acids from Aminonitriles in Titan Conditions

Violet Bradshaw

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

The discovery of amino acids on other celestial bodies is an important sign to discovering life in outer space. Titan is the only moon in our solar system with an atmosphere, and a hydrological cycle. Thus it has many characteristics that are similar to early Earth, a similarity that suggests the likelihood of life. Titan's atmosphere is primarily N2 with 5% CH4 which allows for complex hydrocarbon formation on the surface, and beneath the surface there is a subsurface ocean with communication to the surface via cryovolcanoes. Because of these conditions, there are feasible pathways for amino acid synthesis. However, the differing atmosphere of Titan compared to Earth, the amino acid synthesis pathway is different. Studies have shown that α-amino acids can form from aminonitriles under Titan atmospheric conditions. However it remains unclear if the α amino position would be kinetically favored on Titan. With samples containing α,β, and γ aminobutanitriles, and conditions that mimic Titan subsurface oceans, this project looked at detecting the presence of amino acid formation from their aminonitrile precursors using High Performance Liquid Chromatography (HPLC). Derivatization of the aminonitrile samples was performed to see presence of aminonitrile and amino acid in the sample over time, and therefore how kinetically favorable the production of amino acids was based on the position of the amine group.

Isolating the discrepancy: Testing insulator activity of exogenously expressed CTCF in yeast

Will Brady

Mentored by: Brett Schofield

Wingate University

Gene regulation in eukaryotic cells is highly dependent on the formation of heterochromatin and euchromatin. Heterochromatin is caused by histone modifications that spread to adjacent nucleosomes. This expansion is halted by insulator sequences that serve as binding sites for insulator proteins. Although four such insulator proteins have been identified in yeast (Abf1, Rap1, Reb1, and Tbf1), the only mammalian protein with established insulator activity is CCCTC-binding factor (CTCF). This has led to the belief that other mammalian proteins have undetected insulator activity. Here, we utilize an insulator assay in yeast to test candidate human proteins for the ability to shelter a sub-telomeric gene from silencing via heterochromatin. A previous study has demonstrated that CTCF retains insulator activity when used in an identical assay. However, when we perform the experiment, the Reb1 yeast insulator protein behaves as expected, but CTCF resembles our negative control. This project seeks to explain the discrepancy between our results and the published data.

Mindset and Adverse Childhood Experiences' Effect on Internal Success

Callie Branch

Mentored by: Mark O'Dekirk

Meredith College

Adverse Childhood Experiences' Effect on Mindset and SuccessAdverse childhood experiences (ACEs) have been shown to have effects on how a person develops grit (Duckworth, 2016), which is strongly correlated with success (Cheung et al., 2021). ACEs are traumatic events that occur from ages 0-17 years old.The main goal of this multi-phase study will be to investigate how life success in adulthood may be influenced by the frequency of ACEs during childhood. An additional goal is to determine if someone who experiences a significant number of (ACEs) develops a different mindset as an adult (e.g., futuristic or growth mindset vs. past or fixed mindset) and the degree to which mindset correlates with level of success. I hypothesize the more ACEs a person has, or more fixed mindset, the less internal success (passion, perseverance, purpose, alignment, self-agency, self-satisfaction, engagement, accomplishment, peace, and connection) they will experience. The population I intend to test will be adults 50 and older. The initial phase that I will be presenting involves a validation of a Success Questionnaire (Psychology Today, 2025) that will be validated against the Grit Scale (Duckworth, 2016). Data collection and analyses are ongoing, but the initial wave of data (N=38) collected from Meredith College psychology students indicates several statistically significant moderately strong relationships (e.g., passion and goal setting r = .47, passion and perseverance towards goals r = .49, passion and motivation r = .42, passion and delayed gratification r = .41, perseverance and strong relationships with others r = .42).

Commemorative Practices in Berlin, Honolulu, and Tokyo/Hiroshima since 1945

Matthew Brantley

Mentored by: Andrea Sinn

Elon University

This project will apply a comparative approach to the study of how WWII is represented and remembered in West Germany, the democratic successor to the Nazi regime; the United States, a victorious nation; and Japan, a defeated nation. More specifically, how these countries have engage with the legacy of WWII through public history sites, how these sites both affect and are affected by intergenerational shifts in collective memory, and how institutions synthesize the past into national narratives that educate future generations with the goal of identifying key factors that account for the differences and evolving nature of narratives since 1945. It will employ traditional historical research methods, including archival research and primary source analysis. Particular emphasis will be on the study of public history sites—museums, monuments, and cemeteries— by examining the creators' intentions, public interaction, and my own visitor experiences, to assess each site's central narrative and effectiveness. Through the analysis of commemorative culture in the historically significant cities of Berlin, Tokyo, and Hiroshima, and Honolulu, one can see the ways in which their respective countries have chosen to remember and confront its past through commemoration and the ways in which their approach differ in order to better suit their larger national narratives. The project is part of a larger honors thesis analyzing the commemorative culture of these coutnries that will culminate in a forty-page thesis and a curated museum exhibition about the findings.

Who's your pawpaw: genomic analysis of the parent to a hybrid Asimina species.

Ryan Bravo, Lore Jackson, Jay Bolin, Charles Horn

Mentored by: Francisco Camacho

Catawba College

The small-flower pawpaw (Asimina parviflora) is a relatively obscure species compared to the more famous common pawpaw (Asimina triloba). While the common pawpaw produces large, edible fruit, the small-flower pawpaw produces fruit that are generally < ½ that size. Its range is limited to the southern United States, from coastal Virginia to eastern Texas. Currently, there is no publicly available genome of the species. This research aims to molecularly verify the hybrid status of A. x piedmontana and create a publicly available genome of Asimina parviflora. Leaf samples of A. parviflora were collected from Sumter National Forest, SC. Samples were processed using the Zymo Research Quick-DNATM Plant/Seed Miniprep Kit. The DNA was shotgun sequenced in a Minion flow cell using the Oxford Nanopore Minion Protocol for Ligation sequencing DNA V14. This study has produced roughly 20x coverage with 19.65 Gb of base calls that passed a minimum Q score of 9. This data is significant as it provides genetic insight into A. parviflora, future conclusions about the hybrid status of A. x piedmontana, and in finding its place in the phylogeny of Asimina genius.

Evaluating the extent to which prescribed burns affect plant and bird diversity

Xander Brice, Aashvi Sheliya, Jonah Pil

Mentored by: Zakiya Leggett

North Carolina State University

Prescribed fire refers to the controlled use of fire in a forested ecosystem. This practice has been linked to numerous benefits for the surrounding environment such as increased soil quality, nutrient recycling, and in this case, biodiversity. In this study, six plots on an unburned site and six plots that experienced a prescribed burn were evaluated. This study took place in the Schenck Forest (owned by NCSU). After confirming the environment/area would not affect bird call prevalence, birds in the area were identified using the bird identification app Merlin Bird ID. To identify plant species, the iNaturalist app was used. Each unique plant species and bird species per plot was tallied and recorded. The findings suggested that the sum of the number of birds on the burned plot (26) outweighed the number of birds seen on the unburned plot (16). Plant diversity saw a trend where the sum of the different plant species on the burned plot (19) outweighed those on the unburned plots (13). These findings demonstrate a notable increase in bird and plant diversity. Future studies would explore the relationship between bird habitats and prescribed burns.

The Ethical Governance of Regenerative Medicine and Technological Advancement

Trenton Brooks

Mentored by: Sharon Bullock

University of North Carolina at Charlotte

The field of regenerative medicine sets out to restore or replace damaged biological components of human tissue. Alongside rapid growth in regenerative techniques, a complex regulatory framework has emerged to address concerns about ethics and the legality of patient safety, access, and the boundaries of innovation in the medical field. Understanding the ethical governance of regenerative medicine and technological advancement ensures that the field of regenerative medicine is developed responsibly and equitably. This literature review explores the question of how regenerative medicine can be governed in a way that balances innovation with ethical responsibility, patient safety, and equitable access. Through an analysis of peer-reviewed literature and domestic and international case studies, we can conclude that regenerative medicine is shaped not only by scientific innovation but by a broader sociopolitical, ethical, and legal landscape. For this reason, the ideas that will be explored in this research will answer broader questions about innovation, responsibility, and the societal impact of emerging technologies.

Navigating U.S. Special Education: Experiences of Congolese Mothers of Children with Disabilities

Zoe Brooks, Irene Kessy

Mentored by: Nicole Adams

University of North Carolina at Charlotte

Despite increasing cultural and linguistic diversity in the United States, immigrant and refugee families, particularly those from Africa, remain underrepresented in special education research. This convergent mixed-methods study examines the needs and experiences of Congolese caregivers navigating U.S. public schools and special education. The qualitative phase explored four questions: How did caregivers find information and support when concerned about their child's development or learning? What were their needs and experiences navigating the public school system? What were their needs and experiences obtaining special education support? What were their experiences using WhatsApp as a research method? Six Congolese mothers participated in asynchronous WhatsApp interviews using text and audio responses with interpreter support. The quantitative phase will examine similar topics through a survey with a larger sample of Congolese caregivers of children with disabilities, expanding participation to fathers and other direct caregivers. Existing literature identifies language barriers, limited knowledge of special education systems, culturally inappropriate practices, and disability stigma as potential challenges for immigrant and refugee families. Thematic analysis is ongoing; expected findings include experiences seeking information and support, navigating cultural and linguistic barriers, encountering disability stigma, and drawing on resilience through faith and community. This study centers Congolese mothers' perspectives and may inform culturally and linguistically responsive support for immigrant and refugee families. It also contributes methodological knowledge regarding WhatsApp and interpreter-supported qualitative research with linguistically diverse communities.

Past and Future Century-Scale Projections of Shoreline Evolution Along the Carolina Coast

Aubrey Brostedt

Mentored by: Brad Murray

North Carolina School of Science and Mathematics

Long-term shoreline change along North Carolina's coast threatens coastal communities across the state, yet modeling erosion and deposition due to alongshore transport on extended shorelines over long time scales is complicated by sensitivity to small changes in input conditions that create large differences in the final outputs. This makes it difficult to interpret coastal morphodynamic behavior on the decadal to millennial time scales most relevant to human interactions with the coast. The Coastal Evolution Model (CEM) uses wave angle and asymmetry as inputs to model complex coasts on long time scales (Ashton and Murray, 2006). Previous work has used CEM with downscaled wave inputs derived from historical regional pressure fields to model erosion and accretion across a 400 km coast with 4 capes similar to the Carolinas (Antolinez et al., 2018). The current work uses improved downscaled wave inputs to recreate the historical projections of shoreline positions for the years 1870-2023, and additionally models future shoreline positions from 2024-2100 based on downscaled wave conditions derived from 5 different global climate models. Different wave conditions affect long-term shoreline development, sediment distribution, and coastal shape. This study can serve as a starting point for assessing the viability of various shoreline-regression mitigation methods, allowing us to test whether interventions might reduce erosion in one area while increasing it elsewhere and reveal possible unintended consequences before those strategies are applied in real coastal settings.

Promoting Positive Child Peer Relationships Through Play with the Support of Teachers in Preschool Classrooms

Brook Ellyn Brown

Mentored by: Pamela Norcross

Meredith College

Teachers play an important role in helping young children build relationships. However, there is a lack of knowledge about which teaching strategies are used to best facilitate peer relationship development during play. Previous research has shown that play promotes many important developmental skills as well as social competence (Ashiabi, 2007). Theorists, such as Vygotsky, have established a framework for understanding the importance of having exposure to a 'more knowledgeable other' to help support them in their building of friendships (Vygotsky, 1978). When teachers support play in their classrooms, it develops children's social and emotional development. Young children are starting to learn how to regulate their emotions and understand their own and others', but often need help. Teachers may use different strategies to promote play, including scaffolding or guiding children's play. This study examines the research question, "How Do Teachers Promote Positive Relationships Through Play Between Young Children and their Peers?" Approximately thirty active preschool teachers participated in the study by completing a questionnaire, and a selected group participated in interviews to share teaching strategies. Results are still ongoing and will be completed by the SNCURCS conference. The expected results are that overlapping strategies that teachers use to support play in their classrooms to help strengthen positive peer relationships. This research is relevant because play is becoming less present in classrooms, and this research is being conducted to help educators and other child professionals notice how important it is.

Aye-aye Maternal Peripartum Behaviors

Sydney Brown, Katie Heath, Sawyer Roy, Charlotte Stewart

Mentored by: Lisa Paciulli

North Carolina State University

Little is known about peripartum aye-aye lemur (Daubentonia madagascariensis) behavior. Aye-aye behavior is difficult to observe since aye-ayes are nocturnal and spend the majority of their time in cocoon-shaped nests in trees. In this study, a Duke Lemur Center (DLC) mother aye-aye's behaviors were observed. With Duke IACUC approval, Pelco IMM12027-1S cameras were hidden in a DLC pre-partum female aye-aye's enclosure and nest boxes, and video-footage was recorded for three days. The video-files were viewed and behaviors identified for three hours for each of the three days using 2.5 minute instantaneous focal animal and all occurrences sampling (Altmann 1974). The time, type of behavior, and proximity to the nest were recorded. Data were entered on Google Forms and compiled into a Google Sheet. The footage revealed distinct peripartum behavioral patterns. The day before birth, the mother spent time mostly nest building (23%), sleeping (22%), and traveling (20%) ($p<0.05$). On the day of birth, dominant behaviors shifted to auto-grooming (34%) and traveling (30%) ($p<0.05$). The day after birth, she primarily slept (31%) and rested (30%) ($p<0.05$). Limitations of this study included the sample size, difficulty seeing the aye-ayes, human error in identifying behaviors, and missing synced vocalization. This study gives insight to patterns of aye-aye behavior and can be used to contribute to future captive care and conservation efforts of this critically endangered primate.

Understanding the Power of Sleep

Jarod Brown

Mentored by: Debra Booton

University of North Carolina at Charlotte

Sleep plays a vital role in college students' academic performance, yet many students struggle to get healthy sleep. Demands from coursework, dormitory environments, and daily habits can all make healthy sleep difficult to maintain. In this literature review, I examine how sleep duration, environmental conditions, and behavioral habits interact to influence sleep quality and academic performance among college students. By examining research across psychology, neuroscience, and public health, I found that sleep quality is influenced by more than just how long students sleep. Several factors, such as noise, inconsistent schedules, stress, and poor sleep habits can all contribute to poor sleep, which can affect attention, memory, and academic performance. Overall, research suggests that improving college students' sleep requires focusing on both individual behaviors and the environments in which students live. This literature review highlights the importance of understanding sleep as a major concern for both students and universities.

Assessment of PCB Accumulation in Catfish Muscle Tissue from Crabtree Creek, North Carolina

LaShae Brown, Elise Langer, Adam Harvey

Mentored by: Patrick Myer

William Peace University

In the 1960s and 1970s, improper disposal of industrial waste at the site of Crabtree Creek near Raleigh, NC, resulted in heavy contamination of the waterway with polychlorinatedbiphenyl substances (PCBs). Due to low water solubility and high lipophilicity, PCBs tend to persist and bioaccumulate in the fatty tissues of living organisms. As such, they had been classified as persistent organic pollutants. Our research project aims to assess the PCB contamination levels in muscle tissue of catfish, using the QuEChERS extraction method, in tandem with GC-MS analysis. The catfish are assessed for size and age, the muscle tissue is separated, homogenized, and subsequently extracted with acetonitrile. The supernatant is collected, purified by commercially available QuEChERS kit, and analyzed for PCB content by GC-MS. In our research process we have run into issues regarding our ability to efficiently extract and recover PCBs from fish muscle tissue matrix, while relying on previously published protocols. This is a known issue in fish-tissue extraction, most commonly attributed to high lipid content of fish tissues and high lipophilicity of PCB congeners. At the present stage of the project we are focusing on validating our bench-top protocols, and systematically identifying all the sources of PCB recovery loss within the workflow. Our future aim is to optimize and improve on our PCB extraction protocols, by testing different solvent mixtures, solid state clean-up salts, and manipulating physical conditions for tissue extraction. We focus heavily on method validation, reproducibility, and on the efficiency of PCB recovery from catfish tissues.

The Economic Impacts of Declining Birth Rates: A Literature Review

Cameron Browning

Mentored by: Melinda Adnot

University of North Carolina at Charlotte

For the past 150 years, the world has seen a population explosion unlike any period in human history. While growth has slowed, the global population continues to increase even today. However, birth rates are now declining, leading to an eventual population stabilization and potentially future decline. This literature review will examine the economic impact of the global birth rate decline as it uses several different nations as examples. This literature review synthesizes peer reviewed articles from the fields of economics, demography, political science, and gerontology revealing that birth rates have an initial positive impact on economic systems but display a net negative impact on a nation's economy as low fertility slowly strains a nation's infrastructure. These findings indicate that fertility rates, especially under extreme cases, can dramatically influence the state of a nation's economic strength, financial stability, and infrastructure. Public policies (i.e. nationalized maternity and paternity leave, more funding for affordable child care, etc.) could potentially stabilize a societal birth rate near replacement rate as a means of avoiding disastrous economic and infrastructural decline.

The Philosophy of Ubuntu: A Guiding Principle in Addressing Mental Healthcare Disparities in the Western Cape in Informal and Formal Settings.

Yazi Bulluck

Mentored by: Stephanie Norander

University of North Carolina at Charlotte

South Africa has a high prevalence of various mental health disorders, 75-92% of which go untreated. The Western Cape province, in particular, has both the highest recorded lifetime and 12-month prevalence of mental health disorders in the nation, with anxiety disorders, Post-traumatic Stress Disorder, and substance use disorders being the most common. Previous research also indicates that the Western Cape has an immense shortage of psychiatric and psychological professionals despite the rising need for mental health services. Therefore researchers and mental health professionals have proposed utilizing Ubuntu, an African philosophy meaning "I am because we are," as a guiding principle in tackling mental health care both formally and informally. The purpose of this study is to analyze the history of mental health care in South Africa. A literature review was conducted to identify relevant studies through searches via PubMed, Google Scholar, and the Stellenbosch University database.Additionally, conversations with Stellenbosch University experts guided the literature search and provided critical contextual information regarding the Western Cape. Findings suggest that Ubuntu can be implemented in formal settings through the investment in multidisciplinary mental health care teams and the emphasis of collective care over hierarchical models. Comparatively, Ubuntu can also be leveraged in existing community health infrastructure such as traditional healing practices and family networks, by providing culturally sound community education to equip community members with the ability to address and support individuals with mental health struggles.

Evaluating Prehospital Emergency Medical Services Involvement in Opioid Use Disorder Services: Use of Opioid Settlement Funds

Dhruv Buneti

Mentored by: Julianne Cyr

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Recently, national trends in opioid-related deaths and Emergency Department (ED) visits have decreased. Prior research emphasizes prehospital Emergency Medical Services (EMS) as uniquely positioned to deliver opioid use disorder (OUD) care in the vital time between overdose and ED arrival. However, for continued improvement in OUD services, communities must strategically use opioid settlement funds. This study aimed to describe factors associated with EMS utilization of opioid settlement funds for OUD strategy implementation. We conducted a cross-sectional study of publicly available financial and narrative reports submitted to the Community Opioid Resource Engine-NC by funded entities for the 2024-2025 fiscal year. Using an existing prehospital framework, OUD strategies were coded as prevention, harm reduction, or treatment. Descriptive statistics summarized EMS funding and strategy utilization. In total, 226 documents were reviewed. Across NC, 31.25% (n=35) of funded entities included EMS-based services and 17.9% (n=20) of entities received but did not spend funds. The Piedmont, Coastal Plains, and Mountains regions spent 14.08% ($3,789,863), 12.68% ($3,149,759), and 12.86% ($301,691) of funds on EMS services, respectively. Average absolute (mean[standard deviation]) and proportional strategy utilization scores were: treatment = 2.97 (1.62) and 2.97/12=24.75%; harm reduction = 1.74 (1.32) and 1.74/17=10.24%; and prevention = 1.20 (0.45) and 10.00%. With additional analyses, results will be presented to local stakeholders in future community-based participatory research to explore opportunities to improve prehospital OUD care.

Exploring how early social-emotional protective factors and home language development predict growth in English literacy among multilingual learners

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Despite multilingual learners making up a growing share of preschool classrooms, they remain underrepresented in early childhood education research. This quantitative study proposes to examine how multilingual learners' social-emotional protective factors and home language development predict growth in English literacy in Charlotte Bilingual Learning Center's (CBLC) 4-year-old classrooms. Existing literature suggests that building home language skills can establish a strong foundation for second language development for multilingual learners. Elevating children's home languages and cultural identities has also been associated with early social-emotional development, which can further support English language development. However, limited research has examined how these areas of development interact with one another. To address this gap, multiple regression analysis will be conducted with archival data from seven cohorts of CBLC students (2017-2024) to assess how social-emotional protective factors (measured by the Devereux Early Childhood Assessment Total Protective Factors scale), and home language development (measured by Teaching Strategies Gold), predict growth in English literacy. It is hypothesized that children with greater strengths in social-emotional protective factors and home language development will show greater growth in English literacy. Early literacy is a strong predictor of later academic success, so identifying what supports English literacy growth among multilingual learners is critical. Findings will inform early childhood programming to support social-emotional, home language, and English literacy development, and prepare multilingual learners for success in school.

Fore-Edging: A Study of Decorative Techniques and the Book Cover

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Mentored by: Stephanie Stripling

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Fore-edge painting is a historical form of book decoration that transforms the edges of a book's pages into a surface for artistic expression. This project explores bookbinding literature and photographic archives to examine the history of different bookbinding and decoration techniques. Research shows that book coverings have changed over time with the evolution of technology, but fore-edge painting has remained in practice. Recent trends have also revived the decoration of book ends and coverings, reminiscent of older artistic styles. Books were selected based on the availability of information and the uniqueness of their bindings, coverings, and decorated page edges. Images from selected books display variations of Bible bindings, traditional leatherwork, and fore-edge painting. Review of each image, its binding, and decoration techniques provides insight into book cover history. This project applied these historical techniques to books using modern tools, achieving the desired decorative effect on several book fore-edges. The completed books will be exhibited to demonstrate the application of historical techniques to contemporary artistic practice. The conclusions drawn from this study contribute to the discussion of bookbinding history and emphasize specific and niche techniques that have become less common in modern times. Considering the history of bookbinding and decoration invites us to better understand attitudes towards literature and the arts by helping to revise and modernize these techniques.

Examining Biofilm Formation of Prevalent Nitrate Reducing Oral Biofilm Bacteria Neisseria mucosa

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Mentored by: Michelle Suhan Thomas

Campbell University

Nitrate reducing bacteria have been associated with healthy oral microbiomes while Streptococcus mutans known to cause dental caries. The most abundant genus of nitrate reducing bacteria in oral biofilms is Neisseria. Neisseria mucosa, the most prevalent Neisseria species present in dental plaque biofilms, is a species of bacteria that contains nitrate and nitrite reductase. The association of N. mucosa with improved oral health suggests a possible role for antagonizing the cariogenic species, such as S. mutans. Since Biofilm formation by N. mucosa is not well studied, this research explores the relationship between the presence of nitrates and single species biofilm formation of N. mucosa and S. mutans. A methodology for biofilm growth and analysis for both N. mucosa and S. mutans separately was developed, and adjusted due to biofilm loss. Biofilms were grown on a 96-well plate in BHI broth with and without sucrose or potassium nitrate in a candle jar. Biofilm analysis was performed by measuring the absorbance of the wells using crystal violet. Both bacteria types grew biofilms in 20 mM potassium nitrate with average absorbance values of 1.466 for N. mucosa and 0.531 for S. mutans compared to the BHI with no additives which had average absorbance values of 0.290 and 0.277 respectively. These values suggest that both N. mucosa (about 5 fold difference) and S. mutans (about 2 fold difference) grow better in nitrates. To further examine the effects of nitrate on biofilm formation the next step will be to develop and analyze dual biofilms.

Recovering Sensor Fusion Latency Through System-Level Changes in Autonomous Vehicle Pipelines

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Autonomous vehicles combine signals from multiple sensors, and a message synchronizer groups those signals before passing them to downstream task chains. The waiting this introduces contributes directly to end-to-end reaction latency. Existing work addresses that latency almost entirely inside the matching algorithm: the ExactTime and ApproximateTime policies distributed with ROS, and more recently the SEAM algorithm, differ in how they choose which messages to group, but share the same inputs and the same assumptions about them. We instead examine the decisions made before the synchronizer sees anything. Examples include readings withheld until a full acquisition finishes, stages that run whether or not their output is needed, and sensors waited on despite having nothing new to report. None of these choices are visible to the matching algorithm, yet each one shapes when a group can be formed. Our methodology replays raw, unpaired sensor streams from public autonomous driving datasets through a reimplementation of SEAM, measures where waiting accumulates, and evaluates each candidate change against hand-labeled ground truth using a pre-trained detector, so that any latency reduction is reported alongside its cost in perception accuracy. Preliminary measurements indicate that a substantial share of synchronization delay originates outside the matching rule. Delay of that kind cannot be removed by refining the rule, which makes locating it worthwhile before further effort goes into the algorithm.

Amine-Functionalized MIL-101(Fe)/Activated Biochar Composite for Sustainable CO2 Capture

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In the last 70 years, carbon dioxide levels in the atmosphere have risen at an alarming rate. A potential solution lies in carbon capture materials and, more specifically, metal-organic frameworks (MOFs). This project explores whether it is possible to create an eco-friendly metal-organic framework that can compete with stronger but more hazardous MOFs through CO2 adsorption optimization. Prior research has shown that MOFs can be combined with activated biochar to increase CO2 adsorption and overall structural stability as well as undergo amine functionalization to enhance CO2 selectivity. However, the combination of these two methods remains largely unexplored. The base metal-organic framework is MIL-101(Fe), which has been synthesized through a hydrothermal process. It was then combined with activated biochar, which was derived from Rosa multiflora in a two-step pyrolysis procedure. Amine groups were then grafted onto the activated biochar MIL-101(Fe) composite with branched polyethyleneimine (MW 1200) through incipient wetness impregnation. This final composite and its intermediate stages have been characterized with Fourier transform infrared spectroscopy and powder X-ray diffraction. The cyclic capacity, thermal stability, and moisture resistance of all the composites will then be used to analyze their viability for real-world commercial and industrial environments. The expected result is an environmentally friendly metal-organic framework with adsorption levels that can compete with more hazardous MOFs like MIL-101(Cr). This work would demonstrate a green MOF that can be a practical alternative for sustainable carbon capture.

Documenting road mortality in Carolina Sandhills national wildlife refuge

Gage Caldwell

Mentored by: Joshua Holbrook

Montreat College

Amphibians and reptiles are two of the most imperiled animal groups on earth. One of the biggest causes of this is habitat fragmentation due to rapid urbanization and car-centric infrastructure, more specifically, roads. The rapid expansion of urban life has caused the rise of habitat loss for a multitude of herpetofaunal species and in turn the decline of certain species.

Advancing Immigrant Inclusion and Economic Mobility in Charlotte's Early Childhood Workforce

Rhonda Campbell

Mentored by: Stephanie Potochnick

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Early childcare education (ECE) is a vital part in child development and education, yet immigrant families often face many systemic barriers to finding reliable childcare as well as entering the ECE workforce. Due to local and state policies, opportunities for immigrants in the childcare workforce have been heavily diminished while Latino children lag behind in preschool enrollment rates. This project studies how these policies affect the inclusion and opportunities for immigrants in the ECE workforce. Research into Mecklenburg County shows that Charlotte Bilingual Preschool has helped create opportunities for those in the Latin community to become educators in ECE. Through analyzing federal, state, and local policies in North Carolina, this project will explore the policies that have created obstacles for those in the immigrant community along with those that have helped to advance them. Our research will examine federal policies as well as those in North Carolina. Our expected results will find where some policies support the inclusion and opportunities for immigrants and where others do not. This is important research because understanding how to make immigrant inclusion in ECE will not only open up more opportunities for immigrants in related fields but will also help to improve access to preschool education for immigrant children.

Sintering and Direct Ink Writing of $AlMgB_{14}$

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Aluminum magnesium boride ($AlMgB_{14}$), commonly known as BAM, is a lightweight, superhard ceramic whose combination of wear resistance and low friction makes it a promising material for protective coatings in hypersonic and spacecraft applications. Since our team has only recently received BAM powder, this project focuses on reviewing published studies on how BAM has been sintered into solid pellets and how similar ceramic boride films have been manufactured using direct ink writing (DIW). Sintering is a thermal manufacturing process in which fine particles are bonded into a solid, strong object using heat and pressure without completely melting the material. Studies using methods such as hot pressing and spark plasma sintering have successfully produced high-quality BAM pellets. Recreating these pellets will give our team a control sample for judging the quality of printed BAM films and fine-tuning the DIW process. DIW is a 3D printing method in which a paste-like ink made of ceramic powder is pushed through a fine nozzle and built up layer by layer. After printing, the films must also be sintered to remove the binder and fuse the particles together. Studies on similar boride inks show that the ink must flow easily but hold its shape once printed, and that films often crack as they shrink during sintering. By comparing the conditions and results from these studies, this review will guide our first sintering and printing experiments with BAM powder.

Tracing Origins of Organismal Pollution in Marsh Creek

Abbey Carruthers

Mentored by: Angela Allen

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In Raleigh, NC, numerous waterways are classified as impaired due to documented biological impacts that threaten aquatic ecosystem health. However, limited information is available to distinguish the underlying sources of impairment, including anthropogenic activities, natural processes, and wildlife-related impacts. This study investigated whether human, E. coli, or animal DNA could be detected in the Marsh Creek system, located in Northeast Raleigh, using qPCR assays. We hypothesized that testing would reflect detectable levels of human and E. coli DNA in the water samples. Environmental DNA (eDNA) was collected in two phases. Phase one data was collected over three sites during the summer months in 2025. Phase two data was collected from two of the three original locations during the summer in 2026. Samples were filtered, extracted, quantified, and analyzed using host-specific primer sets targeting human, E. coli, and animal DNA. Initial qPCR trials produced no amplification of targeted DNA, indicating that the target DNA was either highly degraded or below detection thresholds. During phase two, we altered the transport temperature to aid in degradation. To date, we see that host-specific DNA was not detectable under summer environmental conditions, highlighting challenges associated with eDNA-based microbial source tracking in warm, urban freshwater systems. Future work should include sampling throughout the seasons and incorporate higher-sensitivity molecular approaches. These studies present an adaptable workflow for eDNA extraction that could be optimized for high-throughput genome sequencing approaches.

A Mathematical Approach to Prion Protein Misfolding

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Mentored by: Ashley Bennett

Barton College

Prion diseases are a rare form of infectious neurodegenerative disorders that can infect humans as well as other mammals and can also be transferred from mammals to humans. Currently, these prion diseases remain both fatal and untreatable. These serious prion diseases are ultimately caused by transmutation of the prion protein (PrPC), which is natively expressed in the central nervous system of mammals, into an infectious isoform, PrPSc. High resolution NMR and Cryo-EM structures of PrPC and PrPSc have revealed vast structural differences between the two isoforms despite having the same amino acid sequence. While much is known about the specific structural differences between the native and infectious PrPC isoforms, almost nothing is understood about the initial misfolding events triggering the PrP to fold into the PrPSc or the specific details of how a misfolded PrPSc infectious isoform and trigger a non-infectious PrPC into the infectious isoform. Here, we provide a novel mathematical framework for studying prion structures and folding with the goal of building a predictive model. Leveraging experimentally-derived constraints we demonstrate a topology-based model that enables a dimensionality reduction of the coordinate space by projection onto the contact space thus enabling more efficient analysis of the interacting residues and interactions driving the PrPC misfolding to PrPSc. Now that this framework is established, moving forward we will integrate with biophysical, structural, and machine learning analyses to explore the cellular factors that act as predictors for triggering a prion protein misfolding event.

Evolution of Surgical Treatment for Slipping Rib Syndrome: From Cartilage Excision to Structural Stabilization

Leah Cavallaro

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Slipping rib syndrome (SRS) is an underdiagnosed disorder of rib hypermobility that can cause severe chest and upper abdominal pain while mimicking gastrointestinal, pulmonary, cardiac and musculoskeletal conditions. Because conventional imaging may fail to demonstrate the underlying instability patients often experience prolonged diagnostic delays and unsuccessful treatments. This project examines the evolution of surgical treatment for SRS and asks: How have surgical techniques evolved, and what does current evidence suggest about their durability, recurrence and patient recovery? This literature-based study synthesizes clinical reviews, retrospective case series, surgical outcome studies, and physician perspectives addressing SRS diagnosis and treatment. The research compares costal cartilage excision, minimally invasive suture fixation, vertical rib plating, and costal margin reconstruction while also considering interventional approaches such as nerve blocks, radiofrequency ablation, and cryoablation. The literature demonstrates a progression from symptom-focused treatment and cartilage excision toward stabilization techniques designed to address the underlying mechanical instability of the ribs. Though excision can provide substantial symptom relief, recurrence remains a documented limitation. Emerging evidence suggests that stabilization techniques may improve durability by directly correcting abnormal rib movement, while studies of suture fixation demonstrate that short-term improvement does not necessarily indicate long-term success. Overall the research suggests that refinement of SRS surgery increasingly emphasizes structural stabilization rather than temporary symptom relief. However, limited sample sized, retrospective designs and short follow up periods demonstrate the need for further longitudinal research.

The Impact of Which Creativity has Shaped Civil Engineering and Improved the City of Charlotte

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Mentored by: Cindy Gilson

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Charlotte's rapid growth is not a coincidence, it is the reflection of the work of many disciplines working together, where creativity within civil engineering plays a major role. The literature indicates that creativity is a huge part of civil engineering, how it has to be implemented into school curriculums, and what impacts creativity has had in growing cities. This project is important because civil engineering solutions are created by creative processes and with the demand of growth in our time, it is important to future civil engineers to understand how creativity shapes civil engineering. Because of this, my inquiry question has shaped into: How has creative applications of civil engineering practices allowed Charlotte's infrastructure and layout to advance in its sustainability goals even while rapidly growing?. To answer my inquiry question, I am conducting a literature review on improvements that have been made to civil engineering techniques, how creativity has had an effect on those techniques, and how it is being implemented in future engineers and most importantly the city of Charlotte. To observe creativity in the real-world, I will be going to observe a construction site for a new bridge within the city as well as surrounding surrounding parks and trails design from the same company This project is still in progress; however, I anticipate that the answer to my inquiry question will likely be creativity within civil engineering has led to many improvements that can be reflected in the infrastructure and sustainability of Charlotte. In conclusion, the results of this project will be especially useful for current and future civil engineers during their process of problem solving and innovation of new materials or techniques to improve our cities.

Comparing Perfluorocarbon Formulations and Their Effects on BCI Airway Epithelial Cell Viability

Sai Sraddha Chaganti

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Perfluorocarbons otherwise known as PFCs are compounds capable of carrying large amounts of oxygen, making them useful in biomedical and respiratory research. They have been studied for applications such as improving cell culture systems and developing new medical technologies. However, limited research has compared how different PFC formulations affect BCI cells or airway epithelial cells, which are commonly used to model the human airway. This study compares three perfluorocarbon formulations to determine their effects on the viability of BCI airway epithelial cells. BCI cells were cultured in PneumaCult ALI media, a nutrient-rich medium that supports cell growth, and differentiated for approximately three weeks before treatment. The cells were divided into groups that received various perfluorocarbon solutions such as TMC-3283, FC-3283, TMC-3283E, or no treatment acting as the control. Following treatment, cells were stained using a live and dead fluorescent staining technique and imaged with confocal microscopy. Fiji image analysis software was used to quantify live and dead cells and calculate percent viability. Preliminary observations showed no dead cells in the control and TMC-3283 groups, while very few dead cells were observed in the FC-3283 group. Analysis of the remaining images and final viability calculations are still in progress. These initial findings suggest that specific tested perfluorocarbon formulations are compatible with BCI airway epithelial cells. Completion of image analysis and statistical comparisons will help determine whether significant differences exist among the formulations and may provide useful guidance for future respiratory cell culture research.

AeroSleeve: A Passive Acoustic Sleeve for Smartphone Detection of Metered-Dose Inhaler Technique Errors

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Mentored by: Krishi Chayan

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Most patients use their metered-dose inhaler incorrectly, yet clinicians rarely re-check technique. However, existing acoustic monitors mostly require dedicated recorders, airflow whistles, or a phone at the mouthpiece, and no published system detects technique errors with an ordinary phone at a distance. This project asks whether a passive 3D-printed sleeve lets a smartphone detect these errors. We benchmarked seven audio classifiers, including pretrained wav2vec 2.0, on the public RDA inhaler-sound dataset (359 recordings, three subjects), testing each on a subject withheld from training. A random forest on mel-frequency cepstral features identified all 10 held-out actuations in pre-segmented audio (F1 0.95; best published 0.84), but on continuous audio every system faltered (ours mean F1 0.36 over ten runs; best published 0.33), mistaking breaths for actuations. The bottleneck therefore appears to be the recorded signal, not the classifier. To address this, we designed a clamp-on sleeve with two Helmholtz resonators: a 2 kHz sense cavity that concentrates the actuation burst into a narrow band, and a 6 kHz calibration cavity whose known ring corrects for differences between phone microphones and rooms. We hypothesize this signature will separate actuations from breathing and noise for a phone at 30 cm. Printed prototypes will be characterized for resonance accuracy and noise rejection, and cued bench trials will test detection of fast-inhalation, no-breath-hold and no-exhalation errors. If confirmed, a phone and a low-cost printed part could give patients and clinicians objective technique checks between visits.

Maternal Social Support & Postpartum Stress and Anxiety

Meghana Chebbi

Mentored by: Betty-Shannon Prevatt, Pamela Norcross

Meredith College

This research explored the relationship between perceived maternal social support and postpartum stress and anxiety symptoms. Social support has been extensively studied as a protective factor against postpartum depression (Gan et al., 2019) and more recently, in relation to stress and anxiety over time (Racine et al., 2019); yet less research has examined stress and anxiety while accounting for concurrent depressive symptoms. To explore the direct association, controlling for income, age, and depressive symptoms, this quantitative, cross-sectional secondary data analysis uses data from the Advancing Insight into Maternal Social Support (AIMSS) study, a longitudinal project following mothers from pregnancy through the postpartum period. Maternal social support was assessed using the Maternity Social Support Scale (Webster et al., 2000), and stress and anxiety symptoms were assessed using the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995) measured at six months postpartum. Correlational analyses will examine the association between social support and each outcome, followed by hierarchical linear regression models controlling for maternal age, income-to-needs ratio, and depressive symptoms. Quantitative analyses will test the hypothesis that higher perceived social support is associated with lower stress and anxiety symptoms, and that this association remains after accounting for covariates. This research contributes to existing scholarship by isolating the relationship between social support and postpartum stress and anxiety independent of concurrent depression, and by highlighting psychosocial factors that may inform postpartum intervention and support programs.

How Does the Chesapeake Bay Influence Supercell Thunderstorm Evolution and Hazard Production?

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Supercells are intense thunderstorms, characterized by rotating updrafts, capable of producing hazardous weather (e.g., damaging winds, hail, and tornadoes). While most frequent across the central United States, supercells also threaten the densely-populated East Coast. Forecasting supercells within the Mid-Atlantic is particularly challenging due to complex surface features—ranging from the Appalachian Mountains, the I-95 Urban Corridor, and the Atlantic coastline. These diverse landscapes heavily modify temperature, moisture, and winds within the lowest few kilometers of the atmosphere. This variability introduces substantial short-term forecasting challenges, as prior work has demonstrated how supercells exhibit significant sensitivities to environmental properties in the lowest 1-3 km. Mid-Atlantic supercells are also modulated by the Chesapeake Bay, a ~15 km narrow strip of water, that introduces environmental variability via maritime influences. However, the impact of this variability is poorly understood. To address this gap and improve operational forecasting, this study aims to develop a regional climatology of supercells interacting with the Bay using the NEXRAD-derived GridRad-Severe dataset and local storm reports. Analyzing 207 isolated supercells during the 2018–2023 warm seasons revealed that the Chesapeake Bay significantly influenced supercell intensity and longevity. While storms are typically stronger on the western side of the Bay and frequently weaken upon reaching the water, notable variations exist. In unique cases, the maritime environment conditionally maintains or even enhances supercells, warranting further research to disentangle the underlying dynamics. Ultimately, these observational insights improve regional forecasting and establish a critical baseline for future idealized modeling of maritime-influenced severe convection.

Policy Adaptation Targeting Common Hard Failures in Robot Manipulation with SmolVLA

WONJUN CHOI

Mentored by: Chase Wrenn

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Vision-language-action models allow robots to follow plain-language instructions on affordable hardware, but these smaller policies still fail often on ordinary manipulation tasks. The purpose of this project is to determine whether such a policy can become more reliable by learning from its own recorded failures instead of new human demonstrations. Previous research in this area has concentrated on scaling these models with larger pretraining datasets and measuring them by overall success rate on standardized simulation benchmarks. Related efforts that apply reinforcement learning to improve robot policies rely on large models and substantial computing resources. An overall success rate reveals nothing about the specific errors behind each unsuccessful attempt. This project evaluates the pretrained SmolVLA policy across several LIBERO simulation task suites and labels every failed attempt by error type. The most frequent categories include a missed grasp, a wrong object choice, and a placement error. These labels produce a failure profile that identifies the weakest tasks for each suite. The policy is then retrained on those tasks using its own recorded attempts, and performance is measured again across several random seeds. Targeted adaptation is expected to raise success on the weakest tasks while leaving certain error types largely uncorrected. This project contributes a diagnostic framework and a low-compute adaptation method for small robot policies. Affordable robots must fail predictably and recover without human intervention, and these results will show how far failure-driven improvement can carry a small model.

The Heptagram Problem: How Linear Algebra and Symmetry Can Be Used To Search For 7-Point Magic Stars

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Mentored by: Harold Reiter

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The research problem falls in the broader area of magic stars, where numbers 1-2n are arranged at each of the 2n intersections and vertices of an n-pointed star polygon graph and each line of the graph has the same sum. Related research has been done to computationally find solutions for n = 6, magic hexagrams. The purpose of the research is to find all the valid heptagram solutions such that each node is labelled with a distinct integer from 1-14 and each line has the same sum, developing efficient search algorithms and finding algebraic structure in the solutions in the process. In other words, this paper focuses on the n = 7 case of magic stars. The research proves the solutions exhibited rotational and involutional symmetry, using both graphical and algebraic approaches. The problem was then modelled as a linear system, which reduced the search space from 87 billion candidates down to 17 million. Using a backtracking algorithm to successfully find the solutions from these candidates, 72 symmetrical families were found of 14 valid solutions each which remain valid under even-numbered rotation and involution. The broader significance of this research is that it demonstrates how algebraic methods, such as symmetry groups and Reduced Row Echelon Form (RREF), can make graph-theoretic problems more tractable and reveal underlying structure.

Correlation between meat consumption and health and environmental knowledge among undergraduate students

Carolynn Christopher

Mentored by: Kelsey Bitting

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The meat industry has become a major contributor to greenhouse gas emissions, global warming, and environmental degradation. To identify measures that may change consumption patterns towards more plant-based foods, it is necessary to improve understanding on the causes for meat consumption. College students are an untapped resource to understanding meat consumption habits, and may be more open to changing their meat consumption than younger children or older adults. In this project, students enrolled in Intro to Environmental Science survey peers about their meat consumption, environmental and health knowledge associated with meat consumption, and other demographic information. The lead researcher will analyze the data collected by students collected over several semesters to address the following research questions: Is 1) knowledge of the environmental impacts of meat consumptions or 2) knowledge of the health impacts of meat consumption more strongly correlated with reported meat consumption behavior? And, do these correlations vary across demographic groups? By better understanding college student meat consumption and its relationship to other factors, we hope to design interventions that aim to reduce food waste and meat consumption in university dining halls.

A Novel Leaf Color Phenotype in the Semi-evergreen Sand Laurel Oak, Quercus hemisphaerica

Aubrey Church, Kaitlyn Mize

Mentored by: Megan Bowman

High Point University

The environmental factors influencing autumn leaf color in temperate deciduous tree species remain poorly understood but are important for understanding the drivers of ecosystem diversity. Recent studies suggest that cold temperatures may be a key driver of red autumn leaf coloration. Consistent with this hypothesis, we report here observing mature individuals of the brevideciduous oak, Quercus hemisphaerica (Darlington's oak), with red leaves during winter in the coldest extent of its geographic range. Identification of individuals was confirmed using DNA barcoding of five chloroplast and one nuclear gene region. No studies to our knowledge have reported red coloration during winter in this species, as leaves are more commonly green, yellow, and/or brown during winter. However, the co-occurrence of other Q. hemisphaerica individuals in the same area and under the same irradiance exhibiting green and yellow leaves is consistent with reports that other stressors besides cold temperatures, such as nitrogen limitation and/or carbohydrate excess in leaves, may also play a role in leaf reddening. It is also possible that red-leafed individuals were sourced from acorns harvested from populations adapted to warmer climates, as has been previously shown in some species of live oaks.

The World at Your Feet: A Multimodal Assessment of Functional Balance

Jackson Cirami, Keira Chestnut

Mentored by: Neil Petroff

High Point University

Balance generally deteriorates with age, and falls among older adults are a leading cause of injury and loss of mobility. While short-term footwear interventions may improve functional balance, the effects of cumulative footwear exposure on the sensory, muscular, and neural mechanisms underlying postural control remain poorly understood. This pilot study investigates the relationship between lifetime footwear exposure and functional balance using simultaneous electroencephalography (EEG), electromyography (EMG), and force-plate measurements. Participants completed standardized balance assessments while cortical activity was recorded using EEG, lower-leg muscle activation was recorded using EMG, and ground-reaction forces and center-of-pressure were recorded using a force plate. Lifetime footwear exposure was characterized using the Cumulative Footwear Exposure Index (CFEI), a metric developed to account for shoe type, duration of wear, and years of use. Data from all three measurement systems were synchronized in real time, allowing neural, muscular, and mechanical responses to be evaluated together. Final data collection and analysis are currently in progress. This pilot study was designed to evaluate the feasibility and repeatability of the multimodal protocol while generating preliminary data to inform a larger investigation. The resulting methodology establishes an integrated framework for future research examining how cumulative footwear exposure and plantar sensory input may influence neuromuscular and cortical mechanisms involved in human postural control.

The Effect of Limb-Specific Early Reperfusion on Hemodynamics

Patrick Claire

Mentored by: Joseph Stock

East Carolina University

The use of flow-mediated dilation (FMD) to assess hyperemic response and vasodilatory capacity following cuff release is well established. However, it is unknown what impact FMD has on central aortic hemodynamics and whether responses differ between upper- and lower-limb vascular beds. PURPOSE: To determine the acute effects of immediate post-occlusion reperfusion of the brachial artery (BA) and popliteal artery (PA) on central blood pressure and indices of arterial wave reflection. METHODS: Sixteen healthy young adults (11 male; 5 female) completed 5-minute BA and PA cuff-occlusion trials in randomized order, separated by a 20-minute washout. Central blood pressure and aortic hemodynamics were obtained at baseline and early reperfusion (0–15s) following cuff release, a time that typically corresponds with peak reactive hyperemia. Data were analyzed using 2 (limb: BA vs. PA) 2 (time) repeated-measures ANOVA. RESULTS: There were no limb×time interactions or main effects of limb observed for any outcome (all $p \geq .105$). Compared to baseline, central systolic pressure during early reperfusion ($P = 0.24$; 99 ± 7 → 96 ± 11mmHg) was unchanged, whereas central diastolic pressure notably decreased ($P < 0.01$, 72±4 → 66 ± 8 mmHg). A main effect of time showed a significant decrease in augmentation index ($P < 0.01$,13 ± 12% → 6 ± 12%) during early reperfusion. CONCLUSION: The acute central hemodynamic consequences of immediate post-occlusion reperfusion appear to be independent of the vascular territory and involve changes in wave reflection rather than central systolic pressure.

Reading Comprehension Among College Students Listening to Jazz Music

Tyland Clark

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Many college students listen to music while studying, yet research has produced mixed findings about whether background music helps or interferes with reading. This study examined whether comprehension scores differed between students who read while listening to jazz music and students in a comparison condition. Thirty-four college students completed a reading task and comprehension assessment. Eighteen students were in the jazz condition, and 16 were in the comparison condition. Participants also answered questions about their music-listening habits and beliefs. Students in the jazz condition earned higher comprehension scores ($M = 4.11$, $SD = 2.40$) than students in the comparison condition ($M = 2.75$, $SD = 1.00$). An independent-samples t-test showed a significant difference between conditions, $t(23.29) = 2.20$, two-sided $p = .038$. The groups did not differ significantly in their reported study-listening habits or beliefs that music improves performance. These findings suggest that the reading conditions were associated with different comprehension scores in this sample. Further research may help determine when jazz music supports reading comprehension and whether the finding holds with a larger sample.

Gendered Racial Microaggressions, Stress, and Dementia Risk in Black Women

Jada Clark

Mentored by: Candace Brown

University of North Carolina at Charlotte

Black women (BW) experience a disproportionate burden of Alzheimer's disease and related dementias (ADRDs), yet research examining the psychosocial and neurobiological mechanisms that may contribute to this vulnerability remains underexplored. Furthermore, research focusing on social factors - such as gendered racial microaggressions (GRMs), as contributors to increasing vulnerability to ADRDs for BW, is an underexplored realm of ADRD risk. This literature review connects chronic adversity from exposure to GRMs to the development of ADRDs through the adverse mental health pathways. Synthesizing interdisciplinary research from 2018-2025 from psychology, social/behavioral health, neuroscience, and ADRD works, findings reveal that navigating chronic exposure to GRMs require coping and behavioral skills (e.g. shifting, upholding, or pushing back against stereotypes) which may lead to chronic stress, anxiety, identity strain, reduced cognitive inhibition, and depression. These psychological stressors can alter critical hippocampal pathways and dysregulate the HPA axis- two established risk factors for ADRD development. These findings suggest that chronic exposure to GRMs can beassociated with the development of ADRDs through sustained psychological distress. This review highlights the need for further research examining the intersection of gendered racialized stress, mental health, neurobiological functioning, and ADRD risk among Black women and may help identify pathways for future prevention and intervention research.

Social Information Processing and Inequality

Jada Clark, Ryleigh Knox

Mentored by: Lisa Walker

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Social information processing in groups depends not only on the information individuals receive, but also the conditions under which that information is processed. Ensuring that participants are sufficiently task-focused and collectively oriented is therefore essential for determining whether their responses accurately reflect the social processes under investigation. However, these conditions can be difficult to establish and evaluate through the experimental procedures alone. In this study, we examine the methodological processes used to assess participants' task focus and collective orientation within a laboratory study testing the generality of the Principle of Organized Subsets. Analyzing the interviewing and debriefing procedures conducted by the research assistants, this review examines how participant responses were evaluated to determine whether individuals understood the task, remained engaged with the collective process of the interaction, and met the conditions necessary for their data to be included in analysis. Each participant will complete a 20-question assessment on "pattern sensitivity" followed by a brief interview. Synthesizing methodological approaches to participant interviewing, debriefing, and experimental data validation, this review identifies three central themes: assessing task focus, evaluating collective orientation, and identifying responses that indicate insufficient engagement with the experimental conditions. These findings suggest that interviewing and debriefing can function as important methodological checks rather than simply procedural steps following an experiment. The contribution of this literature review is to demonstrate how evaluating participant engagement can strengthen experimental validity by ensuring that data is interpreted only when the theoretical conditions underlying the study have been correctly established.

The Ability of Sown Wheat Seeds to Germinate After Spectrum of Soil Treatments with Thymol-Derived Nanoemulsion Particles

Shaindellie Clemons

Mentored by: Torrence gill

Chowan University

Soil-borne pathogens are a significant risk for farmers who are attempting to maximize their crop yield for the highest profit. In wheat, soil-borne fungal pathogens are a significant threat. Our previous research has shown that treating the aboveground portions of wheat plants with nanoemulsion particles derived from thymol reduced the disease severity of fungal pathogens. Our previous research also concluded that some concentrations of thymol were deemed lethal to plant tissues. Wheat seed soaking in thymol concluded that some of the concentrations would prevent seed germination rates while the majority of the others had no effect. In this study, we are assessing whether the same concentrations of nanoemulsion particles derived from thymol will have similar effects on seeds sown in soil. Our results conclude that, soil components have a significant influence on germination rates specifically at higher concentrations of thymol.

Social Media Engagement and Body Image in University Students

Eva Coles

Mentored by: Michaeline Jensen

North Carolina A&T State University

Social media and its relationship to body image are important areas of research for understanding its potential effects on psychological well-being. As social media becomes increasingly integrated into everyday life, it is important to examine how its use may relate to individuals' body image (Howard et al., 2023). Further research may help us better understand this relationship and whether it differs across racial groups, particularly among Black and White college students.We asked: Do college students who self-report spending more time on social media report poorer body image on average? (RQ1) Are associations between self-reported social media time and body image stronger for Black (vs. White) college students?We examined these research questions in a sample of 150 college students at a minority-serving NC university in 2025-2026 (Mean Age=19.82; 73% female). Among other constructs, students self-reported their weekend and weekday time spent on social media and body image (BAS-2; Zarate et al., 2021). We regressed self-reported body image on self-reported time spent on social media on an average weekday, alongside covariates of age, gender, and race (dummy coded as Black [40%], White [23%], and Other race/ethnicity [38%]. Contrary to our hypotheses, self-reported time spent on social media was not significantly related to self-body image (b=-.001, SE=.062, p=.984), and the strength of this association did not differ by race (p<.05). Future research is needed to better understand intersections between social media use and body image. This should include research that examines how students engage with social media (e.g., for social comparison) and what type of content they are exposed to (e.g., using filters, idealizing certain body types), with consideration for how this engagement may differ for Black young adults.

Songs of Faith and Resilience: The Black Experience Through Art Song

Matthew Cooper

Mentored by: Stephen Stacks

North Carolina Central University

This presentation will consist of a performance of "Balm in Gilead" by Harry T. Burleigh, "Song To the Dark Virgin" by Florence Price, and "Prayer" by Leslie Adams. Through the discussion and live performance of these works, I will explore themes of turmoil, perseverance, spirituality, and the influence of religion within the Black community. Each piece offers a distinct perspective on the ways Black composers have used music to express struggle, hope, faith, and resilience. Central to this presentation is the recognition of works by Black composers, whose contributions have historically been overlooked or excluded from broader discussions of Western classical music. By bringing the music of Burleigh, Price, and Adams together, this presentation will examine how their works communicate aspects of the black experience across different generations, while demonstrating the role of vocal music as a means of cultural reflection, expression, and perseverance. I will give a brief lecture highlighting how these themes appear in the music, after which I will perform the songs.

Design and Synthesis of a Novel Chalcone-Based Therapeutic Both Early and Late-Stage Alzheimer's Disease

Preston Cosby

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

For years, the multifactorial nature of Alzheimer's disease (AD) has prevented researchers from finding promising solutions with treatments often failing to be accessible, failing to work across both early and late stage, or failing to address both the symptoms and the progressive nature of the disease. In order to address these challenges, this study aims to develop a small molecule therapeutic that could alleviate symptoms in both early and late stage Alzheimer's disease while simultaneously slowing disease progression. This will be done by combining symptomatic alleviation which accounts for the cholinesterase shift between early stage and late stage, via ChE inhibition, with lysosomal upregulation to promote the clearance of amyloid-beta plaques and tau fibrils, via XPO-1 inhibition. This study involves the computational design and evaluation of a novel chalcone-based small molecule, the synthesis of the therapeutic, and the validation of target inhibition in vivo and in vitro. A collection of chaclones were evaluated for docking to AChE, BChE and XPO1 as well as pharmacokinetics in Schrödinger Maestro. A candidate was selected that showed improvement compared to existing cholinesterase and XPO-1 inhibitors. The compound was then synthesized using a Claisen-Schmidt condensation reaction and the product's identity was confirmed via NMR and IR spectroscopy. The compound's inhibitory effects are being confirmed in vivo, using Caenorhabditis elegans CL4176, and in vitro with an AChE and BChE Ellman's assay. These computational results demonstrate the compound's potential to treat both early and late stage Alzheimer's patients and suggest a potential future direction for AD treatment.

Before the Exam Room: Internalized Racial Scripts and Patient Behavior Among Black Americans

Preston Cosby

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Black patients in America often report a disproportionately low level of patient satisfaction. This discrepancy is typically explained through cost, access, and racial prejudice. While these factors are incontrovertible contributors to reduced patient satisfaction among Black Americans, they aren't the sole causes; equally important to consider is the impact of patient behaviors on patient satisfaction, and the role of self-image in influencing patient behaviors. Through a long history of racial and gender-based discrimination, American society has established a set of templates based on appearance, as well as gender and racial identity, for self-images to form around. These templates, referred to as racial scripts, can present themselves as positive and negative stereotypes, serving as examples which shape Black self-images. Another restraint on Black Americans' self-images is the manner in which they and their families navigate oppression. Because fighting against racial and gender-based oppression requires certain reactions when advocating for change, Black Americans begin to align themselves with these reactions, placing another template onto their self-image. Finally, the upbringing of Black Americans shapes their self-image and the values they possess. Through the inheritance of generational trauma, distrust towards American systems, and certain understandings of race and gender, the lens through which Black Americans view themselves is once again confined by a set of templates. This project examines how inherited views on gender and race impact Black Americans' self-image, and how this constrained self-image then influences the behaviors Black patients exhibit in healthcare settings.

Reducing Seizure Risk in Glioblastoma Through PVSRIPO-Enhanced EAAT2 Expression in Tumor Macrophages

Sophia Cosmello

Mentored by: Matthias Gromeier

North Carolina School of Science and Mathematics

Glioblastoma is an aggressive brain cancer, and about 20-60% of patients experience seizures over the course of the disease. Currently, treatments like anti-seizure medication focus on treating symptoms rather than addressing the specific biological underpinnings. Glutamate is an excitatory signal, and normally, with elevated levels, astrocytes import glutamate with EAAT2 for cellular processes. However, during Glioblastoma, astrocytes lose this ability leading to a build up of glutamate in the synapses. This buildup creates a greater risk for seizures. During Glioblastoma, macrophages are present at the site of the tumor in greater quantities. PVSRIPO, a modified poliovirus that infects macrophages, has shown promise as an immunotherapy and stimulant for an increased EAAT2 expression in these cells. My project aims to reduce the risk of seizures by lowering glutamate levels by increasing the expression of EAAT2 through infection of macrophages by PVSRIPO. Various experiments were performed on macrophages post infection with PVSRIPO. LEGENDplex assays were completed to read the cytokines released. The strength of EAAT2 expression was determined by western blotting. Lastly, an enzymatic assay was performed to measure intracellular and extracellular glutamate levels. From the experimentation, results suggest that inflammation from PVSRIPO infection may increase EAAT2 expression in macrophages, which aids in reducing glutamate in the brain synapses, hopefully lowering the risk for seizures and other neurological disorders during Glioblastoma. A major limitation is that this experiment does not capture the physiological diversity of the tumor and its surroundings. Future experimentation analyzing PVSRIPO's effects could be performed in brain tissues.

From Pilot to Playbook: Expanding Premedical Student Supported Hypertension Outreach in Primary Care

Madeline Cox

Mentored by: Anjani Reddy

University of North Carolina at Chapel Hill

Hypertension requires monitoring and communication between patients and primary care teams. Home blood pressure readings support hypertension management, but patients may not consistently obtain or report them, and repeated outreach can require clinical time. This work in progress examines whether trained premedical student volunteers can support outreach through a standardized, clinically supervised telephone program. The project expands upon a 2023 pilot at the Greater Los Angeles VA in which one student contacted patients with hypertension, collected patient reported home blood pressure readings, and coordinated handoff of the results to the primary care team. During the pilot, the blood pressure control percentage among participating teams increased from 66.8% to 73.6%, a 6.8 percentage point increase, while comparison teams did not demonstrate substantial change. Blood pressure control percentage was defined as the number of patients with controlled blood pressure divided by the total number of patients with hypertension on the team's panel. Because the pilot was brief and team based, the findings do not establish that student outreach alone caused the improvement. The current project expands the model to five or six premedical students and develops a standardized call algorithm, telephone script, documentation form, training process, and secure clinical handoff procedure. Expected outcomes include a reproducible outreach playbook, reliable clinical handoffs, increased primary care outreach capacity, and meaningful supervised experience for premedical students.

Using Antique Glass Plate Observations for Modern Astronomy

Jacob Crawford

Mentored by: Britt Lundgren

University of North Carolina at Asheville

Before digital cameras, astronomical observations were taken using glass photographical plates. These observations, ranging in age from a few decades to more than a century, offer astronomers a unique glimpse into the past and the opportunity to perform studies with time baseline depths only glass plates can enable. The study of moving, variable, and transient objects is on the verge of a revolution as the Rubin Observatory begins operation. Rubin Observatory's primary objective is to conduct the Large Survey of Space and Time (LSST), which will image the entirety of its visible night sky at a cadence of roughly once every few nights. The LSST is planned to perform observations for 10 years, giving astronomers ready access to study how the night sky evolves during that time frame. Vintage glass plate observations can extend this time baseline for the regions of the sky they observed by decades, or in some cases, over a century. We produced a python notebook that uses digital scans of glass plates to measure how the brightnesses of their stars have changed over time. Additionally, it allows us to make a catalogue of anomalous objects, such as asteroids, comets, and previously unknown supernovae.

Finding Joy in Physical Activity: A Qualitative Investigation of Positive Exercise Cognitions and Their Application to Physical Activity Enjoyment Among Underactive Adults

Meddows Creswell

Mentored by: Sara Levens

University of North Carolina at Charlotte

Despite the well-documented physical, psychological, and social benefits of regular physical activity, engagement remains critically low. Only 1 in 4 U.S. adults meet the combined aerobic and muscle-strengthening physical activity guidelines as issued by the U.S. Department of Health and Human Services. Negative physical activity cognitions function as behavioral impediments by decreasing levels of motivation, autonomy, and competence. Targeted transformation of negative physical activity cognitions into positive, behaviorally salient cognitions may be one route for addressing barriers and increasing physical activity engagement. One way to alter negative physical activity cognitions is through an emphatic application of cognitive and affective reappraisal techniques. The present study aims to advance research in this area by (1) identifying the cognitive barriers and facilitators of physical activity engagement among underactive adults and (2) analyzing thematic consistencies among participants' motivations for pursuing health behavior changes. Interviews were conducted with adults aged 18+ who self-reported engaging in less than 150 minutes of moderate-intensity physical activity per week. Findings are discussed within the context of various health behavior frameworks (including the Capability, Opportunity, Motivation - Behavior (COM-B) model of behavior change) to meaningfully contribute to contemporary society's larger endeavor of developing tailorable and accessible physical activity interventions.

Seeing Water in Soil: Using Low-Field Nuclear Magnetic Resonance to Improve Geotechnical Characterization

Bryn Cribb

Mentored by: Ryan Rasanen

University of North Carolina at Charlotte

Soil pore space contains both water and air, influencing soil deformation and load-bearing behavior. Conventional geotechnical tests characterize properties such as grain size, density, water content, and plasticity; however, direct methods for characterizing pore-water environments remain limited. Low-field nuclear magnetic resonance (NMR) detects hydrogen nuclei in pore water and provides information about their physical and chemical environments. Although NMR is used in medicine, petroleum engineering, and hydrogeology, its application to geotechnical engineering remains limited. This study investigates whether low-field NMR can detect repeatable differences in relaxation-state distributions among clean sand and sand containing nonplastic, kaolinitic, and higher-plasticity fines, and whether those differences change from partial to near saturation. Ottawa F-65 sand is used as the base material with additions of silica fines, kaolin, and OM-4 ball clay. Specimens are prepared at a common global void ratio while saturation, input-water chemistry, specimen geometry, preparation procedures, and NMR conditions are controlled. NMR-derived water content and relaxation-state metrics from independently prepared specimens are compared across soil compositions and saturation levels. The completed dataset will evaluate whether NMR-derived water content agrees with independently determined water quantity, whether relaxation state differences exceed experimental variability, and whether the response depends on fines plasticity, fines content, and saturation. The completed study will determine whether the Helios benchtop NMR system can resolve repeatable, material specific, and saturation dependent pore-water relaxation behavior under controlled conditions. Future research may relate NMR measurements to soil strength, deformation, and pore-pressure response, improving understanding of water-dependent soil behavior relevant to foundations and earthquakes.

The Mortuary Traditions of the Lakota Sioux and the Wounded Knee Massacre

Carson Cusa

Mentored by: Sara Juengst

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Each culture has a different way of dealing with its dead. In Western culture, we bury or cremate our dead, grieve and mourn, and hold onto their keepsakes to keep their spirit alive and their memory close to us. However, in Lakota Sioux mortuary culture, the Lakota Sioux release and give away the keepsakes of the dead so their spirit can cross over. Though, mass death events, such as Wounded Knee, make this difficult. Wounded Knee, described as a battle or massacre depending on perspective, was a clash between Lakota Sioux peoples and the U.S. government resulting from rising tensions surrounding increasingly frequent broken promises from the US government and movements like the Ghost Dance Movement gaining popularity. Because hundreds of Lakota men, women, and children were killed during this event, traditional Lakota mortuary rites were not followed. Today, Lakota peoples mourn these dead through practices such as the "Wiping of the Tears" ceremony, where the victim's belongings are brought to the Wounded Knee site and are mourned, with leaders reading the names of the victims. In this way (and many others), Native cultures have adapted their traditional practices while continuing to uphold their sacred traditions. Through reviewed academic journals, sections and chapters of books, and firsthand accounts and knowledge of what happened at Wounded Knee, I'll be asking who the Lakota Sioux are as a culture, what their mortuary traditions are, and what happens in instances like the Wounded Knee Massacre.

Impact of childhood trauma on students in care work education

Suhani Dadhania

Mentored by: Julie Gibbons

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Early life adversity, as measured using the Adverse Childhood Experiences (ACEs) questionnaire, impacts long-term health and well-being, influencing mental health, chronic diseases, and professional functioning in the general population. Prior research has shown that students in care work education are particularly vulnerable to stress and burnout due to the rigorous demands of their training. Exposure to childhood trauma combined with the demands of care work training can impact the well-being of these students. The purpose of this review is to explore the impact of childhood trauma on students in care work education. To answer the proposed research question, key search terms were used to conduct an exploratory review of the literature. The findings will include a summary of the state of the science around the impact of childhood trauma on students in care work education. In the broader context, this research will illustrate the need to support students in care work education who have experienced childhood trauma through student services and/or curriculum development. This exploratory literature review will provide summarized literature to support the future collection of data on well-being, ACEs, Positive Childhood Experiences (PCEs), and medical trauma of students at UNC Charlotte.

Live Imaging Analysis of the role of Oligodendrocyte-specific TAK1 hyperactivation in Alzheimer's Disease

Jay Dakiwas

Mentored by: Jun Ninomiya-Tsuji

North Carolina State University

Mitogen-activated protein kinase kinase kinase 7 (MAP3K7), known as TAK1, is a central mediator of inflammatory signaling in many tissues. We previously determined that TAK1 is hyperactivated in mouse brains from Alzheimer's disease (AD) models. TAK1 is highly expressed in oligodendrocytes (OLs) and oligodendrocyte progenitor cells (OPCs), which is why this project focuses on the role of OL-lineage cells TAK1 in AD. I have generated mouse models with OL-specific TdTomato expression and OL-specific deletion of Tab2, an inhibitor of TAK1, resulting in TAK1 hyperactivation. I have successfully isolated and cultured neural cells from these mice, which allows me not only to investigate OLs with TAK1 activation in fixed cells but also to monitor morphological changes in live OLs and OPCs, as well as their physical interactions with other cells. Thus far, I have found that TAK1 positively regulates OPC proliferation while blocking OL differentiation. However, the total number of live TdTomato-expressing cells was reduced by TAK1 hyperactivation. In addition, expression levels of mature OL marker genes were reduced by TAK1 hyperactivation. These results suggest that TAK1 positively regulates OPC proliferation, but sustained TAK1 activation reduces the number of mature OLs, potentially leading to dysregulation of myelin sheath production. This project reveals the complexity of TAK1 in OLs' relation to Alzheimer's disease. My project may reveal that fine-tuning of OLs TAK1 is an effective target in neuroinflammatory diseases.

Experimental Noise Mitigation in Offset Tandem Rotors Using NACA 2415 Toroidal Propellers

Abhinav Das

Mentored by: Arun Babu

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The development of electric vertical takeoff and landing vehicles and unmanned aerial systems is currently limited by blade vortex interaction noise. This acoustic penalty occurs when downstream rotors ingest the turbulent wake of upstream rotors in tandem multi-rotor configurations. Building on blade element theory, this ongoing research project investigates whether the continuous closed-loop geometry of a NACA 2415 toroidal propeller can effectively diffuse these concentrated vortices. The central purpose of this study is to quantify the acoustic mitigation and aerodynamic performance of toroidal propellers operating in offset static wake ingestion. To achieve this, a custom tandem rotor test apparatus was engineered using a linear rail system. This allows for precise streamwise and spanwise spatial sweeps to simulate partial and full wake ingestion. Aerodynamic thrust and power draw are continuously measured via an inline load cell and digital data acquisition system, while an off-axis microphone records acoustic signatures. It is expected that the toroidal blades will decrease high-frequency acoustic noise while simultaneously increasing static thrust compared to standard straight blades. Ultimately, this research aims to provide defensible aeroacoustic data that will help engineers design quieter and more efficient propulsion systems for densely populated urban environments and stealth oriented defense applications.

Predicting Before It's Too Late: Machine Learning for Early Identification of At-Risk Students

Sujay Datla, Ruthvik Kantipudi

Mentored by: Amirhossein Ghasemi

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Instructors often identify struggling students only after major assessments and by the time they are discovered, opportunities for early support may be limited. This project determines whether early course engagement and performance metrics can accurately predict students' final grades and identify students who may benefit from early intervention by instructors. Previous learning analytics research suggests that metrics such as assessment performance and attendance can indicate academic risk. The main dataset was based on student data used in a related learning analytics study conducted by Indiana University researchers. It contained 1,200 student records and was divided into 960 training records and 240 testing records. After processing missing values, categorical and numerical variables, and significant outliers, we compared three machine learning models: Regularized Ridge Regression, Random Forest Regression, and Gradient Boosting Regression. Results showed that Regularized Ridge Regression performed best, producing a mean absolute error of about 5.41 grade points on the test set. Quiz and test performance, missing assignments, and late submissions were the strongest predictors of student grades. A dashboard prototype was also developed that allows instructors to enter information for an individual student or upload a class roster to generate predicted grades and risk categories. The results indicate that transparent prediction tools could help instructors identify students who may need support earlier. Work is happening to improve the model's accuracy and evaluate it using real university course data with appropriate privacy protections and institutional approval.

Carbon Outgassing of Inland Appalachian Stream Habitats

Ivy Datta, Jessie Olan, Aryan Kumar

Mentored by: Shea Tuberty

South Piedmont Community College

This study examined carbon dioxide outgassing across 14 stream sites in the Upper South Fork New River and Wilson Creek watersheds near Boone, North Carolina, to determine whether these Appalachian headwater streams act as a net source or sink of carbon and whether gas transfer velocity (K) relates to habitat, elevation, and impervious cover. Headwater streams are increasingly recognized as disproportionate contributors to regional carbon budgets, yet how urbanization affects their gas exchange remains understudied in Appalachian systems. We hypothesized these streams would be consistent net carbon sources and that watersheds with greater impervious cover would show higher gas transfer velocity. Using Pasco PS-3208 wireless CO_2 sensors on a floating apparatus, we measured dissolved water CO_2, ambient air CO_2, and headspace CO_2 across 31 sub-site trials in pools, riffles, and runs over 11 days between June 29 and July 10, 2026. Every site released CO_2 into the atmosphere, and flux rose significantly as the water-air concentration gradient increased ($r^2 = 0.569$, $p < 0.0001$), consistent with gas-exchange theory. Combined with prior-year data, watersheds with over 10% impervious cover showed higher gas transfer velocity than less urbanized watersheds ($t = 3.17$, $p = 0.0034$, Cohen's $d = 1.09$). Stream order and channel type had no significant effect on K or CO_2 concentrations. Elevation related to air CO_2 but not water CO_2 or K. Macroinvertebrate biotic index and family richness correlated significantly with mean K. These findings suggest Appalachian headwater streams are consistent carbon sources whose emissions are shaped by surrounding development.

Recovery Language in Distressed Text: An Interpretable Measure That Transfers Across Corpora

Ivy Datta, Vajra Thota

Mentored by: Caitlin Cameron

South Piedmont Community College

Recovery language, meaning the way people write when describing having worked through hardship, has been studied almost entirely through self-report questionnaires, which only reach people willing to complete them and cannot be applied to writing that already exists. We developed five interpretable linguistic features for detecting psychological distress in text, one of which measures recovery language directly by comparing each sentence against paired recovery and distress reference sentences. Fit on the Dreaddit stress corpus (2,270 posts) and tested on 715 held-out posts, the model reached 75.8 percent accuracy, against 51.6 percent for always guessing the more common label and 69.8 percent for sentiment alone; a fine-tuned DistilBERT reached 79.9 percent but explains none of its decisions. Applied to an independent depression corpus, accuracy fell 12.6 points, which would ordinarily suggest the features had failed to generalize. A three-condition design separating preprocessing from corpus effects showed otherwise: refitting the decision boundary alone recovered 8.8 points using identical features. Recovery language separated the groups with a large effect (Cohen's d = 0.87) while remaining independent of sentiment and negativity (maximum r = 0.21). Four of the five features replicated; joy did not. Because this measure reads writing people already produce, it could let counselors and support programs see whether someone is working through a hard experience without asking them to fill anything out, while showing that a screening tool moved to a new population needs its threshold reset rather than borrowed.

Modeling Hypoplastic Left Heart Syndrome with Patient-Derived Induced Pluripotent Stem Cells to Investigate EFNA1/EphA Signaling

Sophie Davis

Mentored by: Jitka Virag

East Carolina University

Congenital heart defects affect ~40,000 newborns each year in the U.S., with hypoplastic left heart syndrome (HLHS) among the most severe. HLHS is characterized by underdevelopment of the left ventricle, ascending aorta, and often the mitral and aortic valves. Surgical interventions are palliative and do not correct the underlying biological defect, leaving patients with long-term complications and shortened lifespans. While only 10-20% of HLHS cases are attributed to known genetic variants, recent studies implicate endocardial dysfunction and abnormal endocardial-to-mesenchymal transition in disease development. Receptor tyrosine kinases, including ephrinA1 (EFNA1) and EphA receptors regulate cell division, differentiation, and tissue morphogenesis. EFNA1 is essential for cardiac valve formation and endocardial cushion development, while disrupting EphA signaling alters cardiac structure and function in animal models. EFNA1/EphA signaling may therefore contribute to cardiac development and tissue preservation. Using cardiac cells, we collected samples across stages of cardiomyocyte differentiation and used RT-qPCR to profile EFNA1/EphA receptor expression. Preliminary results demonstrate dynamic, stage-specific expression during differentiation, supporting further investigation of their role in cardiac development. We will extend these studies by differentiating patient-derived HLHS and control cells into cardiomyocytes and cardiac organoids, comparing EFNA1/EphA expression and endocardial phenotypes with baseline data, and testing whether activation of EFNA1/EphA signaling can restore endocardial function and alleviate disease-associated phenotypes. This patient-specific in vitro model will connect developmental mechanisms with translational approaches to improve understanding of HLHS pathogenesis and inform future therapeutic strategies beyond surgical palliation.

Education Is a Signaling Game: How Community Differences Shape Labor-Market Outcomes

Simeon Davis

Mentored by: Brandon Dragone

High Point University

This study examines how differences in the cost of education across communities affect education's role as a credible signal of ability in the job market. According to signaling theory, education is valuable when it is costly enough that only individuals with higher ability are willing or able to obtain it. However, educational costs are not equal across communities. Students from wealthier areas often face fewer barriers to earning credentials, while equally capable students from lower-income communities may face higher costs.Using game theory and signaling models, this research explores how unequal educational costs influence employers' interpretation of educational credentials. The study tests whether differences in cost weaken the credibility of education as a signal of ability and contribute to labor market inequality. The findings aim to improve understanding of the relationship between educational access, signaling, and fairness in hiring outcomes

Development and Evaluation of an LC–MS/MS Method for Controlled Drugs and Emerging Adulterants: Assessing Method Performance and Vial Surface Effects

Katherine Davis

Mentored by: Saman Majeed

University of North Carolina at Asheville

Forensic laboratories require reliable analytical methods to accurately identify and confirm illicit drugs and emerging drug-related compounds in complex and adulterated samples. This study developed and evaluated an LC–MS/MS method for the detection and confirmation of fentanyl, xylazine, and BTMPS drugs. Calibration standards and fortified urine samples were analyzed to assess chromatographic separation and method performance. The LC–MS/MS method provided distinct chromatographic separation and reproducible detection of all three compounds in the urine matrix. Method performance was further assessed by examining calibration behavior, and chromatographic characteristics across the tested concentration range, providing evidence of method suitability for forensic drug analysis in complex urine samples. Because analyte adsorption to sample-vial surfaces can reduce the amount of analyte available for injection and potentially affect measured concentrations, we also evaluated whether vial type influenced LC–MS/MS response. Calibration standards and urine samples containing fentanyl, xylazine, or BTMPS were prepared in conventional and surface-treated vials and analyzed under identical conditions. Peak areas at matched concentrations, calibration curves, and measurement variability were compared between vial types. Differences in response were observed among vial types, with the magnitude of the effect varying by compound and concentration. Together, these findings demonstrate the importance of evaluating both analytical method performance and sample-handling conditions when developing LC–MS/MS methods for forensic drug analysis. The results provide insight into factors that may influence the detection and quantitative measurement of fentanyl, xylazine, and BTMPS in urine and highlight the potential impact of vial surfaces on analytical response.

Economic Freedom and Gender Inequality Across Brazilian Regions

Fernanda de Oliveira Sant'Ana

Mentored by: Edward Lopez

Western Carolina University

Economic Freedom and Gender Inequality Across Brazilian Regions Gender inequality remains a persistent challenge in Brazil despite significant advances in women's educational attainment and labor market participation. However, the extent of gender inequality varies considerably across Brazilian states, suggesting that regional institutional differences may play an important role in shaping opportunities and outcomes for women. This study examines whether economic freedom is associated with gender inequality across Brazilian regions. Previous research has found that countries with higher levels of economic freedom often experience more favorable outcomes for women, but relatively little is known about whether similar relationships exist within a single country. Using panel data for Brazil's 27 states over approximately ten years, this research will analyze the relationship between state-level economic freedom, measured by the Índice Mackenzie de Liberdade Econômica Estadual (IMLEE), and multiple indicators of gender inequality. The study utilizes a state-level Gender Development Index (GDI) obtained through the Global Data Lab and is in the process of reconstructing a state-level Gender Inequality Index (GII) using official Brazilian data sources. Data for maternal mortality, adolescent fertility, and labor force participation have already been collected, while the remaining components are currently being assembled. We hypothesize that states with greater economic freedom will exhibit lower levels of gender inequality and higher levels of gender development. This research contributes to understanding how economic institutions may influence gender outcomes in Brazil and provides insights for policymakers seeking to expand economic opportunities for women.

Implementation of Wearable-Based Remote Monitoring in Outpatient Physical Therapy: A Mixed-Methods Pilot Implementation Study

Ava De Simone, Gracie Callahan

Mentored by: Jason Pelletier

High Point University

Consumer wearable usage can potentially enhance physical therapy (PT) practice by increasing physical activity and aiding behavior changes. Despite these benefits, implementation research of wearable-enabled remote monitoring into PT practice workflows is limited. This study examined changes in clinician perceptions and implementation of a wearable-enabled RTM system over time. A mixed-methods approach evaluated implementation and perceptions of wearable devices in five locally recruited outpatient PTs over a three-month implementation period. 5-point Likert scale surveys were developed using established implementation frameworks (Acceptability of Intervention Measure (AIM), Feasibility of Intervention Measure (FIM), Intervention Appropriateness Measure (IAM), Theoretical Domains Framework domains). Monthly interviews were conducted, and inductive thematic analyses were performed to extract the barriers and facilitators to implementing wearables into workflows. No participants successfully utilized wearables to remotely monitor patients. Intervention perceptions decreased from the beginning to the end of the study (AIM -0.75, IAM -1.06, and FIM -1.56). Some barriers that emerged from the survey results were time, cost, clinic support, and workflow fit. Thematic barriers emerged from interviews, including setting/population fit, company culture, PT role fit, EMR integration, and established workflow and trusted intervention. Despite overcoming the barriers to wearable access and education, clinicians identified other barriers that hindered wearable implementation. Future implementation attempts should consider company-wide training and support, identification of ideal patient population, protection of clinician time for monitoring, and integration into current electronic medical record and home exercise program systems.

Recognizing Abuse: IPV Knowledge and Perceptions Among Black Women

Zharia Deese

Mentored by: Erica Campbell

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AbstractIntimate partner violence (IPV) disproportionately affects Black women, yet abusive behaviors may be overlooked or unrecognized until violence escalates. Previous research suggests that cultural, social, and structural factors may influence how Black women understand, recognize, and respond to IPV. Guided by intersectionality theory, this study examines how IPV knowledge and perceptions influence Black women's ability to recognize abusive behaviors early in relationships and explores cultural factors that shape abuse recognition. A quantitative, cross-sectional survey was administered to Black women aged 18 years and older. Findings from 135 participants indicate that respondents reported high confidence in their ability to recognize early signs of an abusive relationship and demonstrated high levels of IPV knowledge. However, respondents indicated that people generally recognize relationships as abusive only after physical violence begins or after severe violence occurs. Physical abuse was identified as the easiest form of abuse to recognize, while emotional, financial, and psychological abuse were most frequently identified as overlooked forms of abuse. Additionally, respondents believed that cultural expectations or stereotypes influence how Black women perceive abuse, and many indicated that additional IPV education is needed within Black communities. These findings highlight a potential gap between knowledge and the recognition of nonphysical forms of abuse and underscore the importance of culturally informed IPV prevention and education. This research contributes to efforts to promote earlier recognition of abusive behaviors and strengthen culturally responsive prevention and intervention strategies for Black women.Keywords: intimate partner violence, Black women, IPV perceptions, IPV knowledge, early recognition, help-seeking,intersectionality

Prediction vs Explanation in Economics

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Mentored by: Brandon Dragone

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This paper examines the distinction between causal explanation and statistical predictive power through a comparison of Menger's causal-genetic methodology and the concept of Granger causality. Menger distinguished between empirical laws, which describe observed institutional regularities, and laws of nature, which reveal the causal structures underlying economic phenomena. From Menger's perspective, economic phenomena must be traced back to subjective valuations, individual choices, and the institutions through which observable outcomes emerge. Granger causality, on the other hand, deals with statistical regularities by identifying relationships based on temporal precedence and informational content. The widespread use of Granger causality in mainstream economics has led to the prioritization of predictive coherence over the validity of competing theoretical explanations, favoring statistical fit over causal explanations and understanding as seen in the case of Mark Thornton and Jason Barr on the skyscraper curse. While Granger causality can be a useful tool for forecasting and analyzing empirical regularities, it does not possess the ability to establish the causal mechanisms responsible for economic phenomena. Drawing upon the methodology of Menger and common critiques of conflating statistics and economics, this paper argues that predictive success should not be conflated with causal explanation. Statistical regularities may illuminate economic phenomena, but they acquire explanatory significance only when interpreted within a broader causal framework. Consequently, Menger's framework provides a more robust foundation for economic explanation than methodologies that treat prediction as evidence of causation.

Assessing Ecosystem Services in Native vs. Ornamental Botanical Gardens at High Point University

Josephine DeRosa, Alexander Ray, Malee Vass

Mentored by: Megan Bowman

High Point University

Assessing Ecosystem Services in Native vs. Ornamental Botanical Gardens at High Point University Josephine S. DeRosa, Alexander J. Ray, Malee E. Vass, and Megan E. Rudock Bowman The Mariana H. Qubein Arboretum and Botanical Gardens at High Point University is an extensive network of over 30 campus gardens, which include a diverse range of native and ornamental flowering plants. In this study, ecosystem services of pollination, predation, decomposition, and nutrient cycling were assessed in campus garden pairs of similar size (i.e., area) and plant diversity but varying significantly in terms of plant species identity – Native vs. Ornamental. The Native Gardens contain a minimum of 60% native plant species selected to support pollination services, while the Ornamental Gardens are primarily planted with annuals selected for their aesthetic appeal. To compare ecosystem services within pairs, pitfall traps were used to collect epigeal arthropods while aerial nets were used to assess insect pollinators. Pitfall traps were placed in each garden randomly within 4 quadrants at equal area density. Traps were collected weekly from March - April 2025 and June - October 2026, after which arthropods were grouped and counted. Using aerial nets, garden areas were actively sampled during a 15-45-minute collection each week (August – September 2025 and March - October 2026), depending on garden size (i.e., area). Collected insects were chilled on ice for 20 minutes, photographed on a 1cm x 1cm grid for identification using iNaturalist, and released. The diversity of epigeal arthropods and pollinators was higher in native gardens when compared with ornamental gardens.

Evaluating FAP Activity and FAP-Dependent Ponatinib Prodrug Activation in Myeloid Leukemia

Brooklynn Devettori

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Ponatinib is an anticancer drug that targets cancer signaling pathways, but its systemic activity in the body can contribute to adverse effects during cancer treatment. Strategies are needed to cause ponatinib to only target cancer cells. Our strategy is to target ponatinib to cancer cells through its interaction with Fibroblast activation protein (FAP), a protein produced by many cancers. An FAP-activated ponatinib prodrug that contains a FAP-cleavable linker designed to be cut in the presence of FAP has the potential to improve systemic toxicity by limiting ponatinib activation until the prodrug encounters cells with FAP, releasing the active ponatinib compound and potentially increasing tumor specificity while reducing systemic exposure. The activity of the prodrug was evaluated with and without the FAP inhibitor (ARI-3099) in three representative Chronic Myeloid and Acute Myeloid Leukemia cell lines (MOLM-13, K562, and KCL22s) using CellTiter-Glo viability assays, which measure cancer cell survival. Free ponatinib was shown to have high potency under all conditions. In contrast, the prodrug was essentially inactive when FAP was inhibited but demonstrated nanomolar toxicity in the absence of FAP inhibition. These data demonstrate that the prodrug activation is FAP-dependent across both FlT3 and BCR-ABL1-driven cancer signaling pathways. These findings support further assessment of FAP expression in blood cancers and the potential of FAP-targeted prodrug strategies to reduce systemic exposure during cancer treatment. Ongoing studies are evaluating FAP activity in patient plasma and tumor samples and examining additional in-vitro models to explore altered prodrug activation under modulated FAP activity.

Muscle Architecture Throughout Growth Following Brachial Plexus Birth Injury

Bhavya Dhiman, Elle Robinson

Mentored by: Jacqueline Cole

North Carolina State University

Brachial Plexus Birth Injury (BPBI) is a pediatric nerve injury caused by excessive stretching of a baby's neck and shoulder during delivery, damaging the brachial plexus nerve bundle that provides movement and sensation to the upper limbs. Most patients recover spontaneously within the first few months, but some develop lifelong arm impairments, including restricted motion or musculoskeletal deformities. Current diagnosis and intervention timelines utilize a "wait and see" method of monitoring for recovery before recommending surgery, which risks missing the optimal intervention window. In our previous murine study at one timepoint (8 weeks), nerve avulsion (preganglionic injury) and nerve rupture (postganglionic injury) exhibited muscle atrophy, reduced longitudinal growth, and reduced optimal muscle length. This study aims to determine these muscle architecture and morphology metrics throughout growth from injury to skeletal maturity. Sprague-Dawley rat pups underwent surgery on one limb 3-6 days postnatally at four time points (2, 3, 8, 16 weeks) in four surgical groups (postganglionic injury, preganglionic injury, limb unloading without nerve injury, and sham control). Eleven muscles affected by BPBI were dissected. Muscle mass and length were measured, and muscle fibers were dissected and placed onto microscope slides; sarcomere length was measured via laser diffraction. Our preliminary findings suggest that postganglionic and preganglionic nerve injuries have lower muscle mass and optimal fiber length compared to the sham group and the uninjured limbs, starting as early as 2 weeks. This study will provide insights into longitudinal muscle changes following BPBI, aiding clinicians in constructing an optimal intervention timeline.

Modeling Tourism-Related Pollution Transport in the Preguicas River, Maranhao, Brazil

Jonah Dickerson

Mentored by: Andrea Presotto

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Rapid tourism growth associated with Lencois Maranhenses National Park is transforming communities and aquatic environments along the Preguicas River in Maranhao, Brazil. This study asks how tourism-related floating pollution may move through and accumulate within the river channel near Vassouras, a major tourist stopping point along routes to Lencois Maranhenses. The project is informed by previous research showing that river currents, tides, shoreline vegetation, and human activity can influence the transport and retention of floating debris, particularly in mangrove environments. It also considers the regional shift from fishing-based livelihoods toward tourism-dependent employment and the environmental pressures that may accompany this transition. To investigate potential debris pathways, three low-cost drifter buoys were repeatedly deployed in the channel near Vassouras over three weeks. The drifters were tracked, recovered when possible, and redeployed to observe repeated transport patterns. Several deployments resulted in drifters becoming trapped beneath or within mangrove vegetation, suggesting that mangrove margins may function as retention zones for buoyant debris rather than allowing all material to continue downstream. These findings demonstrate how low-cost drifter systems can help identify pollution pathways in rapidly changing tourism regions. The study contributes to understanding the environmental effects of blue tourism and provides information that may support future waste-management and ecosystem-protection strategies along the Preguicas River.

Examining the Dissemination of Sexual Health Education Across High Schools

Kelly Diep

Mentored by: Sarah Maness

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School-based sex education varies in the United States, which can have important implications for the sexual health of young people, many of whom are sexually active by the time they reach late adolescence. Nearly half of U.S. high school students have had sexual intercourse (Eaton et al., 2012), with sexual activity increasing from 30% in their first year to 64% in their last year (Boonstra, 2015). Young people also largely comprise newly contracted sexually transmitted infections (Keller, 2020). The U.S. also has the highest teen birth rate of any industrialized country (Demissie et al., 2019). This study explores the dissemination of sexual health education that young adults receive in high school and how it affects current sexual health outcomes. This study used secondary data analysis of an online quantitative survey among a sample of college students in a Southern U.S. state that assessed sexual health, education, and knowledge. Descriptive and inferential statistics were conducted to observe associations between education and sexual health outcomes. Most respondents reported receiving education on various sex-ed topics; however, only 51.8% of participants answered that the material was relevant, and 31.5% reported receiving materials on LGBTQ health. This research provides valuable information on how sex education affects sexual health outcomes of college students. This data can be used to ensure that young people are adequately educated on sexual behaviors and that they will make safe choices for their health.

NOVA: An Edge AI Autonomous Robotic Assistant for Intelligent Construction-Site Inspection

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Mentored by: Gongfan Chen

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Construction-site inspections are critical for ensuring worker safety and monitoring project progress, yet manual workflows expose personnel to hazardous conditions and introduce delays that compound across large-scale projects. Prior work in autonomous inspection has largely depended on cloud-based processing and rigid, predefined robotic command structures — shortcomings that restrict deployment in connectivity-poor environments, introduce latency, and leave systems unable to adapt to the dynamic, variable conditions characteristic of active construction sites. This project investigates whether an edge AI robotic system can autonomously navigate construction zones, capture visual data, and generate plain language inspection summaries entirely on device without relying on external connectivity. NOVA, an autonomous robotic inspection assistant, was developed using a simulation-first methodology that integrates voice command processing, robotic navigation, obstacle detection, computer vision, and on-device language models. The system runs on an NVIDIA Jetson Orin Nano using ROS 2, with a Gazebo simulated construction environment, LiDAR-based obstacle awareness, and OpenCV for image capture. Spoken instructions are parsed into validated zone navigation commands; captured images are analyzed by the Moondream vision language model, and Gemma generates human-readable inspection summaries. Testing confirmed reliable voice command parsing, zone-based navigation, obstacle avoidance, and AI generated scene descriptions within the simulated environment. These results demonstrate the feasibility of combining edge AI, autonomous robotics, and natural language interaction into a unified, infrastructure independent inspection workflow, and establish a foundation for future physical deployment, construction specific fault detection, and real time change monitoring.

Evaluation of Green-Synthesized Mushroom Silver Nanoparticles and Whole Genome Sequencing against Pathogenic Staphylococcus Resistance Genes

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Mentored by: Ewunkem Jude

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Antibiotic resistance represents a critical global health crisis, prompting the investigation of novel therapeutic alternatives. Recent research highlights nanoparticles as a promising strategy due to their unique mechanisms of action, which include disrupting bacterial cell membranes, releasing toxic reactive substances, and delivering antimicrobial agents directly to target sites. These multi-targeted approaches significantly inhibit bacterial growth while minimizing the likelihood of bacteria developing further resistance. In a previous study, we successfully synthesized silver nanoparticles (AgNPs) using mushroom extracts, demonstrating their potent antimicrobial efficacy against both Gram-negative and Gram-positive bacteria. Building upon those findings, the current study evaluates the efficacy of these green-synthesized mushroom AgNPs against a panel of pathogenic bacteria isolated from patients with Staphylococcus infections. Furthermore, this research determines the whole genomic sequencing of the bacterial strains to determine the the presence of resistance genes. Ultimately, the insights gained from this study will provide valuable data for healthcare professionals and researchers seeking viable, biocompatible alternatives to conventional antibiotics in the fight against resistant infections.

ReZo Relaxion Zone

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Mentored by: Serenity Stokes

Central Piedmont Community College

College students often experience insufficient and irregular sleep, which can negatively affect concentration, academic performance, and overall well-being. ReZo (Relaxation Zone) is a relaxation pod designed to provide students with a private, controlled environment for short periods of rest and recovery within an academic setting. ReZo combines adjustable lighting, ambient sound, temperature and ventilation control, and a reclining chair to create a customizable relaxation experience. PDLC smart glass provides privacy while maintaining a modern, immersive environment. These features are designed to support physiological relaxation and help students recover from academic stress and fatigue. Beyond the physical design, the project includes a quantitative feasibility analysis examining implementation costs, projected usage, and break-even potential within an institution such as Central Piedmont Community College. Although challenges include initial costs, limited capacity, and ongoing maintenance, ReZo demonstrates the potential of a compact, technology-enabled relaxation space to support student's well-being and academic success.

Community-Engaged Development of the Preparedness Assessment for the Transition Home: A Reflexive Thematic Analysis of Focus Groups with Caregivers of Individuals with High-Grade Brain Tumors

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Caregivers of individuals with high-grade brain tumors, including glioblastoma, often assume complex caregiving responsibilities while managing rapid disease progression, uncertain prognoses, and transitions from hospital to home. Previous research has shown that caregivers of individuals with high-grade brain tumors frequently feel unprepared for these responsibilities and may have limited access to supportive care resources. This study aimed to evaluate and adapt the Preparedness Assessment for the Transition Home (PATH) to better reflect the needs of caregivers of individuals with high-grade brain tumors. Using a community-engaged qualitative approach, caregivers participated in three focus groups to assess the usefulness, timing, relevance, and completeness of the PATH-25 and PATH-7 instruments. The team coded focus group transcripts in NVivo 15 and analyzed them using Braun and Clarke's reflexive thematic analysis. Coding is complete, and the research team is refining and defining themes, developing visualization maps in NVivo 15, and collaboratively interpreting findings. Emerging themes emphasize the need for anticipatory guidance, preparation for evolving home-based care needs, recognition of caregiver physical limitations, financial and resource concerns, and greater awareness of patient navigation and palliative care services. Participants also indicated that preparedness needs change across the disease trajectory and that the timing and depth of assessment should reflect those changing needs. Findings will guide refinement of the PATH for brain tumor caregivers and inform future psychometric evaluation. This work may improve identification of unmet caregiver needs and support more responsive, individualized care during transitions throughout the illness trajectory.

How DNA Barcoding Can Be Used to Identify Local Bumble Bee Species to Better Protect and Conserve the Endangered Species

Isabelle Douek

Mentored by: Mary Caroline Wolf Staton

North Carolina School of Science and Mathematics

Identifying bumble bee (Bombus) species is a difficult but important task in obtaining critical information about species and habitats at risk of extinction. This study aims to reveal if DNA barcoding can be used to accurately identify Bombus species, improving efficiency in identification. Previous literature claims that DNA barcoding is an effective tool for species identification and monitoring biodiversity of morphologically similar species. This information would be extremely helpful for conservationists who actively seek to protect endangered Bombus species. In this study, a Bombus specimen was collected and identified morphologically through multiple methods such as identification apps (iNaturalist) and dichotomous trees. Following this preliminary identification, the sample was identified through DNA barcoding by extracting its DNA, amplifying it through PCR, and confirming the presence of DNA through gel electrophoresis. The DNA was sequenced by GeneWiz, then identified and compared to related species on DNA Subway. Due to a lack of DNA recovered from the samples, the study was unable to confirm the original morphological identification with DNA barcoding. Although there are various possible explanations for the insufficiency of DNA present in the sample, it is suspected to be related to a scientific error in the process of DNA extraction. Therefore, this study should be repeated with additional care taken to avoid the likely mistakes that occurred. This understanding of what led to the lack of DNA extracted points future studies to identify key points in the DNA barcoding process where techniques should be improved.

Envisioning a violence-free community through Community-Based Zine making

Rain Drennan

Mentored by: Jessamyn Moxie

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Community violence is a multidimensional problem prevalent in our society today. At its most basic, community violence is the exposure to violence in public areas. Both homicide and gun-related assaults have increased in Charlotte, NC from 3,000 a year in 2019 up to 4,000 a year in 2020 (The Way Forward Mecklenburg County Community Violence). Our project aims to expand our community's imagination using zines (do-it-yourself mini magazines) to redirect our attention towards what can be done to prevent community violence. This community-based study evaluated several workshops on community violence. We conducted the multi-hour sessions in two iterations. The first iteration used an dyadic interview-based approach, the second iteration used a guided question conversation approach. This project made an effort to involve participants from a variety of life perspectives, with ranges of experiences, across the lifecourse. Participants (n=25) worked in pairs of 2-3. We collected a recording of the conversations as well as the zines made. We analyzed the zines using content analysis and transcripts using thematic analysis. Zines and debriefing conversations included themes of gendered experiences, environment (e.g. nature), community. Previous research has focused on what factors cause feelings of uncertainty or lack of freedom; however, our research aims to move on from what holds our community back. The findings from this project and from disseminating the participant-created zines can identify community and structural approaches to increase safety and freedom. These may include many aspects of our communities like policy and infrastructure.

Implicit Bias and Formerly Incarcerated Women

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Mentored by: Candalyn Rade

Meredith College

This research explored the nature of implicit bias within the general population toward formerly incarcerated women. Implicit bias has been extensively studied in psychology, including through the work of researchers such as Patrick Forscher (2013) and Mahzarin Banaji (1995); yet, this theory has not been explicitly applied to understanding the experiences of women involved with the criminal-legal system. The experiences of formerly incarcerated women have been widely examined, revealing negative stereotypes and discriminatory actions due to their criminal histories (Fedock et al., 2026). To explore these implicit biases, I conducted an Exploratory Sequential Mixed Methods study (Creswell & Clark, 2018). In phase one, I conducted semi-structured interviews with individuals representing a range of criminal justice-related experiences, from those with no direct connection to the criminal justice system to women with personal incarceration experiences. Supplemental data were collected from additional first-hand written sources. I used Thematic Coding (Braun & Clarke, 2006) to identify recurring themes. Core themes regarding stereotypes, biases, and common experiences provided the foundation for the development of a new Implicit Association Test (IAT) that I designed and developed. In phase two, I administered a quantitative survey of public beliefs regarding the redeemability of formerly incarcerated individuals and the new IAT. Quantitative analyses test the hypothesis that general public participants demonstrate implicit bias toward formerly incarcerated women, and greater bias is associated with less belief in redeemability. This research contributes to existing scholarship by examining implicit attitudes beyond explicit discrimination and structural barriers. It also seeks to increase awareness of formerly incarcerated women's reentry experiences and the social and psychological factors that may influence their reintegration into society.

Preserving Insulin Lispro Functionality Without Cold Storage Using Light-Assisted Drying

Jade Duerr

Mentored by: Susan Trammell

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Insulin is a life-saving peptide hormone for individuals with diabetes mellitus. Like many biologics, it requires cold storage between 2°C and 8°C because ambient temperatures cause protein aggregation and loss of efficacy. Cold-chain infrastructure is expensive and prone to failure, limiting insulin access in under-resourced regions. Light-Assisted Drying (LAD) uses near-infrared laser radiation to rapidly remove water and trap fragile molecules within a stable, protective sugar glass matrix. In this work, the LAD platform was applied to evaluate its capability to thermally stabilize insulin lispro for the first time.Insulin lispro was formulated with a 0.2 M trehalose buffer solution. Droplets (40 μL) were irradiated with a near-infrared laser while sample temperature was monitored via thermal imaging. Polarized-light imaging confirmed that LAD-processed samples successfully maintained an amorphous state with no crystallization. Rehydrated samples evaluated via ELISA demonstrated that functional binding was preserved relative to controls, whereas heat-damaged controls exhibited a significant reduction in binding. These results highlight LAD as a promising method for cold-chain-free insulin stabilization. Future work will include cell-based functional assays, extended storage trials, and in vivo animal studies.

Group Size, Participation, and Problem Solving: A Pilot Study

Zaria Dunn, Jalen Delacruz Williams

Mentored by: Kulwinder Kaur-Walker

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Group size may influence individual participation and performance during collaborative problem-solving activities. The purpose of this pilot study was to examine the effect of group size on participants' ability to solve riddles, with particular attention to completion time and accuracy. Because the initial experimental procedure did not yield sufficient data to adequately evaluate these outcomes, the present preliminary analysis focused on participants' self-reported experiences with group participation and task-related processes to inform refinement of the experimental design. Thirty-nine participants completed the study questionnaire. Most participants (76.9%) reported that they normally participate in group work or activities. Verbal contribution during group projects averaged 2.46 (SD = 1.05) on the 5-point Likert response scale. Responses concerning group size indicated variability in perceptions of whether smaller groups facilitated participation (M = 3.26, SD = 1.33) and whether larger groups made contribution more difficult (M = 3.10, SD = 0.82). The questionnaire also assessed participants' experiences with a word-memory component, including ease of remembering words and the perceived usefulness of writing words while hearing them. These preliminary findings provide information about participants' experiences with collaborative participation and task strategies. Results will be used to refine the experimental procedure for subsequent examination of how group size affects problem-solving speed and accuracy.

Eastern Bluebirds nesting preference patterns

Hollyn Dunn

Mentored by: Jeff Thomas

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Eastern Bluebirds (Sialia sialis) are common cavity-nesting songbirds throughout the Carolinas and readily occupy artificial nest boxes. We investigated Eastern Bluebird reproductive success within an urban-suburban habitat mosaic in south Charlotte, North Carolina. We monitored standardized nest boxes located at a field site in the Ballantyne area throughout the breeding season from May through early August. The study examined the relationship between the timing of nesting events, clutch size, number of fledglings, and overall nesting success among nest boxes related to environmental characteristics. We used fiber optic cameras to observe nesting activity and document reproductive events while minimizing disturbance to nesting birds. Canopy cover, nest box availability, rainfall, geographic location, proximity to water, and compass direction, were also recorded for each nest box. Results from 2026 were compared to data collected during previous years to identify potential patterns in nesting behavior and reproductive outcomes overtime. By examining bluebird nesting success within an urban-suburban landscape, this study provides insight into how environmental conditions influence reproductive behavior and contribute to the conservation and management of Eastern Bluebird populations in developed habitats.

Methods of Psychological Intervention in School Based Systems for Immigrant and Refugee Students

Salma El-Houshy

Mentored by: Diane Zablotsky

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Charlotte, North Carolina is a rich and culturally diverse city, home to a robust immigrant and refugee student population of more than 26,000 migrant students across its public schools, colleges, and universities. Given that Charlotte has a large immigrant and refugee student population, it is even more important to increase awareness and understanding of the mental health experiences of this demographic within educational spaces. This project is part of ongoing research looking into what resources in mental health and education exist in Charlotte school-based systems for immigrant and refugee students. Additionally, this research aims to examine which psychological interventions are particularly beneficial for this population of students in this setting. This portion of the project utilizes a critical literature review that explores studies done on the benefits of several kinds of psychological interventions in school-based systems, including talk therapy, art and music therapies, and cognitive-behavioral interventions. This research investigates how different kinds of interventions impact the psychological growth of immigrant and refugee students, and how it relates to their adjustment in a new setting. There are many factors, including cultural differences, traumatic or difficult backgrounds, and socioeconomic status that shape the unique experiences of this population, especially in the institution of education. The primary goal of this project is to highlight the benefits of specific methods of psychological intervention with immigrant and refugee children and adolescents, and to discuss how these methods can be better implemented in school-based systems, not just in Charlotte, but across the country.

Financial Literacy in College Students

Emma Elliott

Mentored by: Nikki Chappell

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This project examines financial literacy among college students and explores how a practical budgeting tool can encourage greater awareness of personal spending habits. Financial literacy is an important skill for young adults as they begin managing their finances independently, including saving, budgeting, managing credit and debt, and making informed financial decisions. Previous research indicates that young adults are particularly vulnerable to poor financial decision-making and that financial literacy among younger populations has declined, potentially contributing to long-term financial challenges such as poor investment decisions, inadequate retirement planning, and difficulty managing debt. Building on this research, this project investigates whether an accessible budgeting tool can help college students better understand and manage their finances. I developed a system using Microsoft Forms and Excel that allows users to record income and expenses each time money is earned or spent. The information is organized in Excel, where users can set up a budget, monitor remaining funds, and view spending patterns through percentage-based pie charts. I am testing the tool through my own financial activity and documenting my experiences to evaluate its usefulness, organization, and ease of use. The project will identify potential improvements to the tool and examine how tracking and visualizing financial activity may encourage more conscious spending. This research contributes to a practical approach to addressing financial awareness among college students.

Student mental well being at jcsu

Farah Elshahat, Travis Dixon

Mentored by: Douglas Cooper

Johnson C. Smith University

Students' health and well-being predict academic performance, retention, and overall experiences in college. Understanding challenges to student health and well-being can help universities develop effective support for their students. The present study examined mental health concerns, food insecurity, sense of belonging, and intentions to withdraw among students at Johnson C. Smith University (JCSU. The study also aimed to identify areas where additional university resources and programs may support student success. In the Spring 2025 semester, 95 students completed the American College Health Association-National College Health Assessment (ACHA-NCHA; 2025), Results showed that 24.4% of students reported serious psychological distress, 75.6% of students reported low or very low food security,.53.2% of students agreed or strongly agreed that they belonged at the university, 40.4% agreed or strongly agreed that the university prioritizes student health and well-being, and 16.1% of students reported that there were likely or very likely to withdraw and transfer to another university, Results were compared to the national sample. Recommendations are made to improve student support at JCSU, including strengthening resources to improve mental health, increase food security, and sense of belonging. These recommendations can help increase health and well-being and improve student experience and success.

Spatial Equity in Electric Vehicle Charging Infrastructure: Assessing Displacement Vulnerability Across Charlotte's Neighborhood Profile Areas

Rose Exum

Mentored by: Marco Scipioni

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Empirical evidence in recent years illustrates the magnitude of the U.S. transportation sector's adverse climate consequences. Electric vehicles (EVs) have emerged as a prominent greenhouse gas mitigation strategy, but the transition to EVs raises questions of equity regarding the distribution of Electric Vehicle Charging Infrastructure (EVCI). In Charlotte, these concerns prevail amidst displacement and gentrification pressures in marginalized neighborhoods. This study examines the spatial relationship between EVCI and displacement vulnerability across Charlotte's Neighborhood Profile Areas (NPAs). The results indicated that vulnerable NPAs had slightly higher average charging station counts and density than non-vulnerable NPAs. While correlation analyses retrieved only weak bivariate relationships, negative binomial regression revealed that higher displacement vulnerability was associated with higher station counts after accounting for overdispersion, suggesting that the relationship is more complex than simple correlation models capture. These findings signify that charging infrastructure is not distributed uniformly and access may intersect patterns of housing precarity and even gentrification. Additionally, they emphasize the importance of guiding future EVCI investment with equitable frameworks and anti-displacement policies to ensure the expansion of green infrastructure does not exacerbate existing urban inequities. Keywords: electric vehicles, displacement vulnerability, gentrification, housing precarity

Mutations of AtpI and subunit a of ATP synthase in Pseudomonas aeruginosa.

William Fairley

Mentored by: Ryan Steed

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Bacterial ESKAPE pathogens, such as Pseudomonas aeruginosa (PA), are notable due to their increasing antibiotic resistance, with a significant negative effect on patient outcomes. From this rise in resistance, various new targets need to be explored to inhibit bacterial growth. The ATP synthase complex is a promising antibiotic target within PA, due to the crucial importance of ATP to cellular energy. Our goal is to characterize mutations in two genes of interest, atpI and atpB encoded by the atp operon in PA. Currently, atpI is hypothesized to produce a chaperone required for the assembly of the membrane-embedded Fo sector of PA ATP synthase. The atpB gene encodes subunit a, which facilitates H+ transport through the complex and has features unique to PA. Our goal is to characterize mutations in these two regions in order to determine the effect of substitution mutations in atpI and atpB on Fo region assembly and proton transport, respectively. Mutations were made in a whole-operon plasmid at sites hypothesized to be important for ATP synthase functions, and resulting strains were assayed for succinate growth and the in vitro H+ pumping and ATP synthesis activities of inverted membrane vesicles. We found that the atpI mutants have minimal impact on ATP synthesis function or proton pumping. However, in subunit a, substitution mutations in the H+ exit channel increased proton pumping activity with lesser effects on ATP synthase activity, suggesting that these residues may control the direction of H+ transport.

Spatial Analysis of Toxic Soil Metals Around Historic Buildings in Durham, North Carolina

Lily Fang

Mentored by: Daniel Richter, Anselme Dossou

North Carolina School of Science and Mathematics

Lead contamination from historical lead-based paint and gasoline remains a persistent problem in urban soils because lead's relative immobility allows decades-long persistence. Previous research in Durham, North Carolina, has shown elevated soil lead concentrations near older building foundations, but fewer studies have examined how consistently these patterns occur across historic properties or how contamination extends below the soil surface. This study investigates the spatial distribution of soil lead around 12 historic buildings in Durham and evaluates how concentrations vary with distance from buildings, soil depth, and site characteristics. Building footprints and sampling locations are georeferenced using a GNSS rover to reconstruct site layouts for spatial analysis. Surface soils are collected around transects extending 0.5, 2, 4, 8, and 12 meters from foundations, while selected sites are sampled by soil depth. Lead concentrations are measured using calibrated portable X-ray fluorescence. ArcGIS maps concentrations and identifies spatial hotspots, while RStudio analyzes relationships among lead concentration, distance, depth, and site. Preliminary data from four historic sites reveal higher lead concentrations near foundations that generally decrease with distance from foundations, but vary substantially among locations. At The Ark on Duke University's East Campus, concentrations range from 18 to 10,961 ppm, with 45.24% of samples exceeding EPA's residential soil lead screening level of 200 ppm. Together, these spatial and depth-resolved measurements demonstrate how historic buildings can create persistent, highly localized soil lead hotspots and provide a framework for targeted urban soil sampling and exposure assessment.

Evaluating Barriers and Facilitators to the Implementation of Long-Acting Injectable Buprenorphine in Community Pharmacy Settings

Brianna Farrell

Mentored by: Grace Marley

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Long-acting injectable buprenorphine (LAI-B) is effective and can be offered either weekly or monthly, which is an alternative to sublingual buprenorphine that is dosed two or three times a day. Access to this drug formulation is limited. Fortunately, community pharmacies in North Carolina can administer LAI-B, however there is little known about the practice. This literature review aims to evaluate the current literature regarding LAI-B in community pharmacy settings to learn more about the barriers to implementation. We conducted a scoping review of research studies in PubMed, Scopus, Embase, and CINAHL, utilizing the key words “pharmacy” “buprenorphine” “long-acting injectable”. Our search found a total of 22 studies that related to the topic. Ten studies were included for a full text review. After the full text review, 6 studies were included for this literature review. Studies from the patient perspective indicate that LAI-B is effective, and administration was easier with the long-acting medication as opposed to sublingual daily administration. Also, studies identified barriers to pharmacy-based LAI-B administration to include pharmacist stigma regarding opioid use disorder, lack of space to administer LAI-B, and lack of pharmacist training on this service. Future research should explore pharmacist implementation of LAI-B in community pharmacies, and opportunities to reduce pharmacist stigma regarding opioid use disorder.

Advanced Manufacturing: Rapid Assembly

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Mentored by: Tandeka Boko

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Advanced manufacturing processes such as 3D printing are often used for simple visual models, but desktop Fused Deposition Modeling (FDM) offers practical solutions for functional hardware. This project evaluated FDM printing across two real-world mechanical applications: modular tool-free assembly and consumer repair. First, we printed a modular stingray (Model A) to test how snap-fit joints perform during rapid assembly without external tools. Second, we reverse-engineered and printed a high-wear plastic component for a household vacuum (Model B) to test whether parts can withstand operational stress when replacements are costly or unavailable. Model A results: The implementation of a modular snap-fit design reduced the assembly time and simplified the process by eliminating the need for tools. Optimizing the print orientation also reduced stresses associated with repeated disassembly and improved manufacturing efficiency by eliminating the need for support material. Functional testing was conducted to evaluate the fracture behavior of the wings at the throttle interface. The results demonstrated that the specimen maintained its structural integrity when submerged in water, showing no signs of fracture and remaining buoyant. Model B results: 3D-printed components can serve as effective replacements for inaccessible parts. However, the vacuum seal was imperfect and required an external force to maintain the vacuum. Mechanical testing showed a decrease in strength at infill densities above 45%, a trend consistent across all materials tested and print orientations. By testing both snap-fit joint clearance and functional load capacity, this study highlights how standard FDM printers can yield durable, tool-less, and cost-effective end-use parts.

Increasing the Functional Recovery and Cognitive Performance with Feverfew (Tanacetum parthenium) in the Drosophila melanogaster Familial Hemiplegic Migraine Type-2 Model

Tylyyn Flood

Mentored by: Jennifer Williams

North Carolina School of Science and Mathematics

This project aimed to investigate the effects of medicinal extract derived from Feverfew (Tanacetum parthenium) on transgenic Familial Hemiplegic Migraines Type II (FHM-II) Drosophila. FHM-II, is a type of migraine that causes paralysis to half of the body during attacks. It is hypothesized that the parthenolide in the Feverfew extract stabilizes the ion channels in the fruit fly brains, therefore improving the migraine recovery time.. Feverfew powder was turned into extract through a rotary evaporation process of acetone then ethanol for a higher yield of parthenolide, confirmed through Thin Layer Chromatography (TLC). Different concentrations of the extract were combined with standard fly food and females flies at 3-4 days old were fed for five days. A heat shock assay was performed at 42C, where flies were placed in vials and their time to knockdown and recovery was measured. A negative geotaxis axis was used as markers for the effectiveness of the different concentrations of the treatment. To date, the data has shown no statistically significant difference in the control group and treatment groups of concentrations at 1uL/10mL, 10uL/10mL, and 50uL/10mL. As the project progresses, higher concentrations of treatment will be explored, as well as raising flies on the treatment to compare results. Different concentrations will continue to be explored to research the effects that Feverfew has in treating FHM-II in a transgenic Drosophila melanogaster model.

Dual-Stress Adaptive Evolution of Synechococcus elongatus UTEX 2973 Under Elevated CO_2 and Nickel for Bioremediation Applications

Eduardo Flores

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North Carolina School of Science and Mathematics

Industrial activity contributes to multiple forms of environmental stress, including elevated carbon dioxide emissions and heavy-metal contamination. As of May 2024, atmospheric CO_2 reached about 426.7 ppm, roughly 50% higher than preindustrial levels, while fossil fuel combustion and industrial processes still account for a large share of global greenhouse gas emissions (Ma et al., 2025). At the same time, heavy metals can persist in aquatic systems and interfere with microbial physiology. Nickel is biologically relevant at trace levels, but elevated concentrations can stress microorganisms and disrupt photosynthetic performance, oxidative stress responses, and metal-related cellular pathways (Hassanien et al., 2025). Cyanobacteria are promising organisms for integrated remediation because they perform oxygenic photosynthesis, fix inorganic carbon, and can interact with metal ions through adsorption, transport, sequestration, and stress-response mechanisms (Mangan & Brenner, 2014; Hassanien et al., 2025). This study investigates whether adaptive laboratory evolution (ALE) can improve Synechococcus elongatus UTEX 2973 performance under combined elevated CO_2 and nickel stress. UTEX 2973 is a fast-growing cyanobacterial strain developed as a chassis for light- and CO_2-driven biosynthesis, making it well-suited for short-term experimental evolution (Yu et al., 2015). Cultures will be exposed to elevated CO_2 and sublethal nickel concentrations, with fitness measured through OD_{750} growth curves, lag phase, final culture density, pH response, chlorophyll/pigment retention, fluorescence microscopy, and, later, nickel removal from BG-11 medium. This project tests whether repeated selection under dual stress can generate cyanobacterial cultures with improved growth, photosynthetic stability, and functional bioremediation potential compared with non-evolved controls.

From Experience to Belief: Examining the Relationships Among Adverse Childhood Experiences, Sexual Communication Self-Efficacy, and Rape Myth Acceptance

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Mentored by: Kirsten Li-Barber

High Point University

Rape myth acceptance (RMA) reflects beliefs that minimize, excuse, or justify sexual violence, and has been associated with gender and self-efficacy-related factors among college students, particularly among college-aged men (Navarro & Ratajczak, 2022; Hust, 2019). The present study examines whether adverse childhood experiences (ACEs) are associated with differences in sexual communication self-efficacy (SCSES) and RMA, while also considering gender as a potential factor in these relationships. Participants consisted of 827 individuals who completed self-report measures, including the Adverse Childhood Experiences Questionnaire (ACEs), Sexual Communication Self-Efficacy Scale (SCSES), and the Illinois Rape Myth Acceptance Scale (IRMA). It was hypothesized that greater exposure to ACEs would be associated with lower SCSES and greater RMA. It was further hypothesized that gender would play a critical role, with men expected to report higher levels of RMA than women. Results indicated that ACE scores were not correlated with SCSES, $r = .045$, $p = .208$, or RMA, $= -.017$, $p = .636$. However, SCSES was negatively correlated with RMA, $r = -.188$, $p < .001$, indicating that greater communication self-efficacy was associated with lower RMA. Gender did not significantly influence these relationships. Findings run contrary to previous research which may be due to differences in sampling demographics, as the current study utilized a large national sample of individuals rather than primarily college aged students. Future implications will be discussed, including whether age may help explain these findings given the broader age range represented within the sample.

Evaluating the Effects of Blocking Peptide MHCP3 on Dendritic Cell Antigen Presentation in MASLD

Emily Flynn

Mentored by: Arion Kennedy

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Metabolic dysfunction-associated steatotic liver disease (MASLD) is a chronic condition characterized by high fat content in the liver caused by high dietary fat, excessive sugars, and metabolic dysfunction. In the context of the disease, dendritic cells in the liver can activate CD8+ T cells, leading to hepatic inflammation and fibrosis. Our lab has identified a hepatic self peptide (Ncf2) that is unique to MASLD. However, it remains unclear how the peptide contributes to MASLD progression. In efforts to understand function, our lab has engineered a blocking peptide MHCP3 to competitively bind to the MHC Class I molecule to prevent antigen presentation to CD8+ T cells, thereby blocking downstream T-cell activation. This study aims to focus on understanding how these MASLD-related peptides are produced and recognized by dendritic cells, and how MHCP3 impacts dendritic cell activity and survival. We expect that MHCP3 will successfully block the Ncf2 peptide from binding without inducing dendritic cell toxicity. By using peptide binding assays and flow cytometry, we will evaluate the distinct impacts of both the Ncf2 peptide and MHCP3 on dendritic cell viability, phenotypic maturation, and antigen-presentation efficiency. These insights will complement previous research to identify new treatments for MASLD.

Banking with Gen Z: How can Ally Bank connect with the next generation

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Mentored by: Steven Cox

Queens University of Charlotte

This project investigates Generation Z's attitudes, behaviors, and priorities regardingbanking to identify strategies Ally Bank can use to better attract and connect with youngerconsumers. Existing research suggests that Gen Z's expectations for financial institutionsare influenced by factors such as digital banking experiences, financial knowledge,perceived value, and evolving financial priorities. To establish this research context, weconducted a literature review examining Gen Z banking behaviors, mobile bankingadoption, and Ally Bank's current marketing strategies, supplemented by insight from amember of Ally's marketing research team. Our methodology combines this secondaryresearch with primary research conducted through surveys and focus groups examiningGen Z's banking knowledge, preferences, behaviors, and perceptions. We expect ourfindings to indicate that the challenge extends beyond a disconnect between Ally Bank andGen Z specifically and may reflect a broader lack of engagement with and understanding ofbanking among younger consumers. These findings may support a marketing strategy thatemphasizes financial education and communicates banking benefits according to thepriorities of Gen Z consumers. Ultimately, this research aims to provide Ally Bank withactionable insights for building relationships with the next generation of bankingcustomers and remaining competitive as their financial needs and expectations develop

A little goes a long way; a study in SE Raleigh, NC by Aurelien Fradin, Angela Allen, Sarah Brim

Aurelien Fradin

Mentored by: Angela Allen

North Carolina State University

Environmental degradation in our waterways is a persistent problem, especially in urban streams embedded in historically underserved areas. In Southeast Raleigh of the Walnut Creek Watershed there are two main communities, Rochester Heights and Biltmore Hills, which sit low in the floodplain, and therefore are at risk of more frequent flooding events. In this study, we are investigating several locations throughout Little Rock Creek and the Walnut Creek Watershed to continue monitoring the impact of environmental stressors. A YSI multiparameter meter is used in the field to investigate dissolved oxygen (DO), specific conductance (SPC), temperature (T), and pH to help determine risks from polluted runoff. Grab samples are taken and samples are analyzed in the lab weekly for turbidity and nitrogen nutrients. In addition, biweekly grab samples are collected to test for the presence of E. coli using the IDEXX Colilert system. Expanding from previous studies, I will analyze geospatial information (GIS) to deduce the sources of pollution and areas of degradation. Comparing mapping with monitoring results will provide more detail in the analysis of Little Rock Creek and the Walnut Creek Watershed. This study will deliver an extensive understanding of the water quality trends in and around the neighborhoods of Southeast Raleigh which assist in regulating and preventing pollution that affects the residents.

A Qualitative Case Study of Leadership Development and Sense of Belonging Among First-Generation, Low-Income Junior and Senior Undergraduates in High-Impact Practices

Tan Francis

Mentored by: Courtney Simpson

North Carolina State University

This pilot study examines how participation in High-Impact Practices (HIPs) influences leadership development, campus engagement, and sense of belonging among first-generation, low-income (FGLI) undergraduate students at a large public research university in the Southeast. Despite the well-documented benefits of HIPs for student success, FGLI students participate at disproportionately lower rates due to systemic barriers, including financial constraints, off-campus work obligations, and limited institutional awareness. Guided by Bandura's Social Cognitive Theory and Astin's Theory of Student Involvement, this exploratory qualitative case study centers on the lived experiences of students who navigated these barriers and engaged in at least one HIP during their undergraduate career. Data will be collected through an initial participant interest survey, followed by a demographic questionnaire, participation in a focus group, and reflections from approximately 5 to 8 FGLI junior or senior-level undergraduate students who have completed at least one HIP. Transcripts will be analyzed using coding to uncover patterns related to why students did or didn't engage, how their sense of self as leaders shifted, and whether they felt they truly belonged on campus. Keywords: High-Impact Practices, First-Generation College Students, Low-Income Students, Sense of Belonging, Leadership Development, Student Engagement, Higher Education, Access

Bridging Cell Fate Reprogramming: Precision Bipolar Waveforms to Restore DNA mobility in the Tumor Microenvironment

Aditi Gadde

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Despite advancements in genetic medicine, safe, non-viral delivery platforms for vaccines and CRISPR therapies remain a clinical challenge. Gene Electrotransfer (GET) permeabilizes cell membranes using electrical pulses, but traditional long-duration monopolar pulses cause intense muscle contractions. While ultrashort symmetrical bipolar pulses eliminate pain, they cancel out the electrophoretic force required to move large, negatively charged DNA through dense tissues. This project addresses the debate between clinical efficiency and patient comfort by optimizing a painless, asymmetric waveform. To test this, target cells embedded in 3D collagen tissue mimics are injected with a GFP reporter plasmid. An algorithmic controller then applies patterned, asymmetric, ultrashort bipolar microsecond pulses, for which we specifically used 2-1-2 and 2-1-1 phase-duration protocols via a specialized coaxial ring and pin electrode. These protocols are engineered to restore DNA mobility without melting the tissue. Transfection efficiency and cell viability are evaluated using Propidium Iodide dye, green fluorescent protein (GFP) expression, and COMSOL Multiphysics software to computationally map the boundary lines between successful transfection and irreversible apoptosis. This 3D spatial mapping will identify an optimal asymmetric waveform that maximizes transfection within safe thresholds, which establishes a foundation for painless, non-viral gene delivery. While the simplified collagen model and small dye molecules do not fully replicate the complex, hypoxic tumor microenvironments or heavy plasmid dynamics, future research will validate these engineered waveforms on diverse cancer cell lines and complex tissue models to ensure real-world clinical efficacy.

Building Targeted Degraders & Inhibitors for the DNAJ-PKAc Fusion Protein in Fibrolamellar Carcinoma

Sheba Gage

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Fibrolamellar hepatocellular carcinoma (FL-HCC) is a highly aggressive liver cancer that primarily affects young adults. Most patients with FL-HCC express DNAJ-PKAc, a fusion protein produced by the DNAJB1-PRKACA fusion gene. Because the catalytic domain and active-site pocket are highly conserved between DNAJ-PKAc and wild-type PKAc, small molecules that bind the active site are likely to inhibit both proteins, which could lead to side effects from inhibiting wild-type PKAc. Proteolysis-targeting chimeras (PROTACs) recruit a target protein to the cell's ubiquitin-proteasome system for degradation. PROTACs have demonstrated degradation selectivity between closely related kinases, including CDK4 and CDK6, suggesting that an active-site-binding ligand may still be a useful starting point for developing a selective degrader. Therefore, analogs based on BLU-286, a known PRKACA inhibitor, were synthesized and evaluated as potential target-binding ligands for future DNAJ-PKAc PROTAC development. Cellular target engagement of synthesized compounds against DNAJ-PKAc and wild-type PRKACA was evaluated using NanoBRET assays. Three synthesized compounds, SCG-39, SCG-40, and SCG-41, engaged DNAJ-PKAc with half-maximal inhibitory concentrations (IC50) of 482, 674, and 518 nM, respectively. However, these compounds did not demonstrate selectivity over wild-type PRKACA. Additional analogs, including SCG-62, SCG-63, and SCG-64, were synthesized to explore structural modifications that may improve fusion selectivity. Continued optimization may identify suitable ligands for PROTAC development, where degradation selectivity could potentially be achieved despite engagement of the conserved kinase active site. In parallel, a DNA-encoded library screen provides a complementary strategy for identifying ligands that bind elsewhere on the DNAJ-PKAc fusion protein, potentially enabling greater fusion selectivity.

Childhood Abuse and Obesity: Testing Gene-Environment Interactions

Sneha Galla

Mentored by: Aura Mishra

North Carolina State University

Childhood Abuse and Obesity: Testing Gene-Environment InteractionsBackground: Research has shown that childhood abuse is linked to higher rates of obesity across life. However, few studies have examined how multiple types of childhood abuse and genetic risk together impact obesity in adulthood. To address this gap in current knowledge, we examine the role of childhood abuse types and their multigenic interaction for obesity outcomes in adulthood. Methods: A sub-sample of 3,211 individuals from The National Longitudinal Study of Adolescent to Adult Health was used to address the primary research aim utilizing multivariate linear models. Results: Exposure to childhood physical, emotional, and sexual abuse ($b = 0.97$, $p = 0.03$), and exposure to only physical abuse ($b = 0.74$, $p < 0.01$), were associated with higher BMI during adulthood at high genetic risks. Conversely, exposure to childhood physical and emotional abuse ($b = 0.58$, $p = 0.02$) was associated with higher BMI at all levels of genetic risk for adulthood obesity. Conclusions: Whereas certain types of childhood abuse exposure can contribute to obesity outcomes in adulthood even when there is low genetic risk, other types of abuse exposure interact with high genetic risk to influence obesity outcomes. Keywords: Obesity, Childhood Abuse, Gene-Environment Interaction

Overcoming Cold-Chain Limitations: Thermally Stabilizing Inactivated Poliovirus Vaccine with Light-Assisted Drying

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Vaccines are sensitive biologics that require refrigeration/freezing and lose potency when exposed to conditions outside recommended temperature ranges. This has major real-world implications. For example, inadequate access to cold-chain infrastructure is a primary contributor to global undervaccination, particularly in low-resource regions. A clear example of this is the Inactivated Poliovirus Vaccine (IPOL), which is currently distributed as a liquid requiring continuous storage between 2-8 °C. Light-assisted drying (LAD) presents an alternative stabilization method that creates a protective amorphous sugar matrix around the biologic. This allows for ambient-temperature storage and bypasses the need for a cold chain. In this study, 0.25 mL IPOL samples in glass vials were dried via illumination with an infrared laser. Sample temperatures were monitored in real time using thermal imaging to prevent thermal degradation during processing. The structural integrity of the sugar matrix was evaluated using polarized light imaging, and post-drying antigenicity was quantified using enzyme-linked immunosorbent assays (ELISAs). Preliminary results demonstrate that we can form a robust sugar matrix that preserves vaccine antigenicity. Future work will evaluate long-term thermal stability across elevated temperature ranges and assess in vivo efficacy through animal studies.

The Influence of Gen Z Preferences on Banking Choices: Strategies for Ally Bank

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Mentored by: Steven Cox

Queens University of Charlotte

As Gen Z consumers begin making more independent financial decisions, understanding what influences their banking choices is becoming increasingly important. To explore these preferences and their potential impact on banking decisions, this project will examine how Ally Bank can increase the number of Gen Z consumers who have an account with Ally. Previous research on Gen Z and banking suggests that factors such as social influence, convenience, promotional offers, digital access, advertising, and social media can affect how young consumers choose a bank. To better understand which factors matter most, our research will use a survey of Gen Z consumers. Participants will rate the importance of these factors when choosing a bank, allowing us to identify which preferences have the greatest influence on their decisions. The findings will also help us evaluate how well Ally's current offerings address the preferences identified by Gen Z consumers. We expect the results to identify the factors that Gen Z considers most important when choosing a bank and provide insight into areas Ally could focus on when trying to attract new Gen Z customers. This research is important because it connects Gen Z banking preferences to Ally's efforts to grow its customer base among young consumers.

The Dirt on Equine Asthma: A retrospective study analysis of environmental soil types contributing to equine asthma

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Equine asthma is a widespread chronic respiratory disease characterized by distinct phenotypes based on specific inflammatory airway cells. Evidence suggests that environmental factors significantly impact equine respiratory health. However, a gap remains regarding how local soil types and specific asthma profiles are interlinked. This lack of data prevents horse owners from optimizing environmental management to minimize respiratory distress in their horses. This retrospective study utilizes the VetGenus database to compile clinical data from 135 horses who presented to NC State equine hospital for the past 5 years with either mild, severe or no asthma. Simultaneously, a 8 question survey was emailed to horse owners gathering local geographical data including soil characteristics. A Fisher's exact statistical test will be performed on the combined datasets to evaluate the level of correlation between different soil types and asthma phenotype. 44 responses have been collected from owners and analysis has been completed with an indication of almost no correlation between these two variables and rather association due to random chance. The results may be due to a limited sample size due to time constraints on the duration of the study. Regardless, this data will provide direct insight between localized geographical conditions and neutrophilic, eosinophilic or mastocytic asthma. It enables veterinarians to create more strategic long term care plans for patients presenting with mild/moderate or severe asthma. This pilot study highlights the vital unexplored correlation between soil and asthma types. These results can guide future studies to optimize preventive environmental management plans for horses.

Mediterranean Mood: A Student Self-Study on Diet and Mental Health

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Mentored by: Steph Stripling

South Piedmont Community College

Diet quality has been linked to mental health outcomes, with ultra-processed foods associated with higher rates of depression and anxiety, while nutrient-dense diets such as the Mediterranean diet are linked to improved mood and brain function through anti-inflammatory and neuroprotective mechanisms. This self-study examined how food consumption impacts mental health and mood by comparing a control diet week to a Mediterranean diet week among four college-aged participants. Using a mixed-methods design, participants tracked meals and mood through photos, meal descriptions, and a six-point mood scale submitted via Microsoft Forms across a two-week period (February 28–March 13, 2026), yielding 465 total responses. Quantitative mood data were analyzed statistically, while qualitative meal descriptions were examined for thematic patterns using Voyant Tools. Results showed a shift from a control week dominated by processed, sugary foods to a Mediterranean week rich in whole grains, lean proteins, fruits, vegetables, and healthy fats. Positive mood ratings rose from 62% to 72%, negative moods declined slightly, and all participants reported increased energy, greater fullness, and more structured eating patterns during the Mediterranean week. Findings suggest that short-term dietary changes toward a Mediterranean pattern may meaningfully improve emotional well-being and energy in young adults. Given rising rates of stress and anxiety among this population, this research highlights dietary intervention as an accessible, low-cost strategy for supporting mental health and underscores the value of further study with larger samples and longer time frames.

Charlotte: The Ever-Changing City: A Literature Review

Jennifer Garcia Torres

Mentored by: Kyle Spence

University of North Carolina at Charlotte

The rise of banking in Charlotte in the 1980s and the consistent population growth in the decades since have shaped Charlotte's urban core and influenced the city's evolving cultural identity. As a result, criticism has grown surrounding the connection between Charlotte's new development and the rise of a homogeneous architectural landscape. The goal of this literature review is to identify the major driving forces of Charlotte's development, examine the connection to architectural homogeneity, and explore its influence on culture and identity. Synthesizing peer-reviewed articles on architectural theory and research on urban development, housing patterns, and population growth reveals three central themes: urban infill, smart growth, and new urbanism. These findings suggest that in the last decade, Charlotte's development has tried to follow the core principles of New Urbanism and smart growth, which focus on creating walkable and sustainable cities. As a strategy to try to accommodate Charlotte's rapid population growth, we have seen the rise of high-density development or urban infill, such as apartments, to meet housing demand. While these strategies look to mediate population growth while creating an urban environment that supports it, the continued use of such developments may contribute to a more homogeneous architectural landscape. The contribution of this literature review is to highlight the tensions of urban growth with the struggles of preserving and expanding the cultural identity in a densifying city.

Neoliberalism 'a la mexicana': Understanding Mexican development debates before the 1982 debt crisis

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Mentored by: Jürgen Buchenau

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The perceived “black-gold” prosperity of the late-1970s Mexican oil boom came to a shocking end by 1981, leaving many middle- and lower-class Mexicans unable to afford daily necessities. After Mexico declared a debt moratorium in August 1982, when it could not make payments on its foreign debt, President José López Portillo signed an agreement with the International Monetary Fund (IMF) 3 months later that implemented an austerity program and made large cuts to public spending. Previous scholars have argued that the IMF brought Mexico into a period of neoliberalism and austerity. However, my research argues that neoliberal thought was already prevalent, as US-trained Mexican technocrats critiqued state-led development outside IMF pressure for economic restructuring. I source my findings in a little-known right-wing Mexican newspaper, Razones, using 5-6 articles published between August 1980 and May 1982. These findings are important because they emphasize the role of a domestic policy debate among Mexican intellectuals rooted in criticism of state-led development, desarrollo compartido, the government’s dependence on oil, and a devastated agricultural sector that may have influenced the thinking of affluent Mexican readers in business, economics, politics, etc. One article particularly recommends spending discipline among Pémex (Petróleos Mexicanos). This research will advance scholarly conversations about Mexican autonomy beyond external factors and reframe the role that Mexican technocrats have played in contributing to neoliberalism. Based on my research in Razones, I argue that the growth of neoliberalism was there before the debt crisis.

Factors that Contribute to the Academic and Social Success of First-Generation College Students

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Mentored by: Amy Peters

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Many students go to college seeking opportunity, especially if they are the first in their family to attend. However, first-generation college students often face more challenges than their non-first-gen peers along the way. Some students may not know where to go for help, how to use campus resources, or how to navigate college expectations. In this literature review, I examine factors influencing the academic and social success of first-generation college students. Using peer-reviewed research from higher education, sociology, and psychology, this literature review is structured around four main themes: social and cultural background, individual and psychological factors, academic and behavioral factors, and institutional culture and structure. These findings suggest that access to college alone does not guarantee success; instead, success depends on the interaction between what students bring with them and how well institutions accommodate their needs. The purpose of this literature review is to reframe first-generation student success as a multidimensional, interactive process, and to argue that institutions must move beyond simply providing resources toward building cultures that actively reduce stigma and normalize help-seeking.

An Analytical Home-Run: How Predictive Analytics on Batting Statistics Have Impacted Improving Baseball Teams

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Mentored by: Bienvenido Rodriguez-Medina

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In recent years, baseball general managers and coaches have increasingly incorporated predictive analytics into decision making to build a competitive edge for their teams. After looking through research papers and books, this literature review was made to explore how these two groups use predictive analytics to build rosters in the draft and in free agency, determine the most efficient batting lineup, and train batters to predict where a pitch is going to be. A majority of the limited research was done over the last twenty years due to the topic being a very new development with many studies including the use of AI, simulations, and models based on statistics like Wins Above Replacement. Through this research, it was discovered that managers are able to optimize their cap space by getting players that fit specific needs, and help them focus on who to prioritize in the draft. Coaches are able to use the statistics to determine if they should use the same lineup every game or if they should change it up. Coaches are also able to see how through predictive models they can tell their pitcher where a ball is likely heading in certain situations and what type of pitch is likely to be thrown. Through the advancement of computing power and the ability of teams to use their data to make decisions, researchers are now trying to better understand the outcomes of these changes in practice.

Antibiotic Resistance: Evaluating Antimicrobial Properties of Soil Microbes Found in Human-Influenced Soils

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Mentored by: Chasity Moore

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Antibiotic resistance is a growing global concern, creating an immense need for the discovery of new antibiotics. Tiny Earth has developed a program that allows student sourcing and experimentation to potentially isolate new antibiotics from soil microbes to combat antibiotic resistance. This project aimed to connect soil ecology and medicine by exploring the bacteria found in local soils collected from South Piedmont Community College campus. We hypothesize that soil bacteria will produce isolates for potential novel antibiotic production. Soil samples collected from SPCC were analyzed using established Tiny Earth protocols to isolate bacteria from soil samples to aid in the discovery of new antimicrobial compounds. These compounds are discovered by bacteria producing zones of inhibition in plated samples. All zones of inhibitions observed in our preliminary results came from the soil sample collected near the back patio of SPCC's campus, a heavily human-influenced area. Our preliminary results found two microbial isolates with slight but clear zones of inhibition. These findings suggest that soils with high human activity may contain microbes with antimicrobial potential. In conclusion, these findings highlight the potential for soil microbial diversity as a great resource for antibiotic discovery which can overall address the rising challenges presented in global healthcare regarding antibiotics today.

Breaking the Cycle: Understanding How Domestic Violence Goes Unaddressed and Identifying Ways to Increase Change

Macayla Gay

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Countless individuals in the US experience intimate partner violence, an issue that spans across multiple different socioeconomic, racial, and demographic groups. However, despite the vast nature of this problem, a majority of people who experience domestic violence do not report it, seek assistance, or exit their vulnerable situations, leaving them trapped in continued harm. While public perception often scrutinizes victims for remaining in abusive relationships, the decision to leave is often hindered by complex structural and psychological obstacles. This study examines barriers such as economic dependency, lack of trust in legal justice, fear of retaliation, and societal expectations that prevent victims from getting the support they need. This research aims to provide insight on early warning signs in order to prevent future harm along with improving systems to create safer, more supportive environments in which affected people feel empowered to seek help and end intimate partner violence. By analyzing obstacles to reporting domestic violence and identifying effective prevention strategies, it may be possible to observe a shift in the prevalence of unaddressed relationship violence.

Euphemisms for Grief: The Inadequacy of Public Language for the Private Expression and Experiences of Loss

Andrea George

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

While grief is universal, it is a deeply personal experience shaped by culture and constrained by language. When societal pressures replace the vocabulary for loss with gentle euphemisms, individuals lose the language that is required to cope, triggering psychological instability. This paper examines how the distortion of language disrupts the relationship between private experience and public mourning, forcing individuals to reinterpret irreversible loss as recoverable. Through a literary analysis of C.S. Lewis's A Grief Observed (1961), Cheryl Strayed's "The Rumpus Advice Column #78: The Obliterated Place" (2018), and the psychological framework established in On Grief and Grieving: Finding the Meaning of Grief Through the Five Stages of Loss (2005) by Elisabeth Kübler-Ross and David Kessler, this project treats textual narratives as psychological mirrors of ideological pressures, effectively diagnosing how cultural structures suppress authentic mourning. Ultimately, this project argues that analyzing the language of loss is essential to redefining grief: not as a condition to be cured, but an existential condition to be permanently integrated into the human experience.

Transcriptional Changes in Human Bronchial Epithelial Cells Exposed to Various Combustion-derived Particulate Matter

Anish Ghosh

Mentored by: Ilona Jaspers

North Carolina School of Science and Mathematics

Air pollution has harmful impacts on human health. One major type of air pollution is particulate matter (PM), which is smaller than 10 microns. Although, PM have diverse chemical and physical characteristics, the Environmental Protection Agency (EPA) only considers size for evaluating and regulating PM. PM has detrimental effects on bronchial epithelial cells upon inhalation. We aimed to identify how PM mixtures derived from different locations and combustion processes alter gene expression in primary human bronchial epithelial cells. RNA was extracted and sequenced from human bronchial epithelial cells cultured at air-liquid interface and exposed to four different PM mixtures: urban PM from Xinxiang, China and Ottawa, Canada; diesel exhaust; and residual oil fly ash (ROFA). RNA sequencing was performed and differential expression of genes and biological pathways associated with each type of PM exposure was evaluated by computational analysis in R. After exposure to PM from Ottawa, Xinxiang and diesel exhaust, the CYP1B1 gene, encoding key toxin metabolizing enzymes, was upregulated, while LOX, encoding lysyl oxidase, an enzyme involved in tissue remodeling, and SCNN1G, encoding a subunit of the epithelial sodium channel that regulates airway hydration, were downregulated. Additionally, altered biological pathways were explored, including pathways related to oxidative stress and DNA repair. We demonstrate that across 3 of the 4 types of PM tested, genes and pathways related to oxidative stress, xenobiotic metabolism, and tissue repair were affected. This provides important data that may inform regulatory polices by EPA, guided by PM composition rather than particle size.

From Feedback to Action: Student and Expert Perspectives on Bystander Intervention Measures for Problematic Alcohol Use

Jianaa Ghosh, Anne Jane Campbell

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Problematic Alcohol Use (PAU) persists among college students and is associated with an increased risk of accidental injury and sexual assault. Existing literature identifies likelihood, action, and barriers as factors affecting BI, but often overlooks key social influences specifically in the context of PAU. The Bystander Intervention for Problematic Alcohol Use Model (BIPAUM) was developed to bridge this gap through a systematic bystander intervention (BI) approach for PAU among peers. This study aims to develop and refine items across two scales: Assessing Outcomes (AO) and Assessing Support (AS), which assess outcomes after intervening and perceived support for intervening in situations involving concerning alcohol use, respectively. Feedback surveys were administered online via Qualtrics from January to July 2026. A total of 207 undergraduate students and 11 experts evaluated survey items, instructions, and response scales for clarity and relevance using ‘yes’, ‘no’, and ‘not sure’ response choices with open feedback. Item percentages of unfavorable responses were calculated, with higher percentages indicating an item was unclear or unrelated. Item revision included removal, clarifying wording, and adding context to improve comprehension. Refined scales contained 24 AO items (from 63 initial items) and 33 AS items (from 48 initial items). Future analyses will include an exploratory factor analysis to examine factor structure as well as a confirmatory factor analysis to assess the fit of the identified factor structure. Refinement of these scales can improve assessment of BI for PAU and provide a better understanding of factors that influence intervention among college students witnessing peer PAU.

Dining on the Wing: Insect Diet Preference Among Big Brown Bats Across Ecoregions and Temporal Scales in North Carolina

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Mentored by: Michael Cove

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Among mammals, bats are the only taxonomic group to possess the unique trait of powered flight. This has allowed them to take advantage of the abundance and diversity of flying insects as a food resource. As a state with four distinct seasons and three distinct ecoregions, North Carolina makes an ideal candidate for studying how insect diet preference among bats may shift between both time of year and region. Currently, minimal work has been done within the state to properly record these potential shifts in diet. My research seeks to discover and understand these potential shifts through stomach content analysis of the big brown bat, Eptesicus fuscus. I hypothesize that there will be seasonal differences in the diet among big brown bats, in close association with the insects of greatest emergence during the time of year they were collected. In the summer, I predict bats will prey primarily on annually emerging cicadas, while on warm days of winter they will focus on flight-swarming subterranean termites. Specimens of the big brown bat are sourced from the State Rabies Laboratory and are housed within the mammalogy collections of the North Carolina Museum of Natural Sciences. Individual bats undergo an initial dissection, followed by the removal and later dissection of the stomach. Stomach contents are removed and mounted on microscope slides for identification down to the genus level. We expect to find regional differences in diet among big brown bats given different habitats that lend to varied insect diversity.

Daily Stressors and Physical Symptoms: Chronic Conditions and Perceptions of Control Matter

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Mentored by: Shevaun Neupert

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Chronic conditions can bring an array of physical symptoms that can be worrisome and disruptive to daily activities. Stress (i.e., psychological response to external demands that exceeds one's resources) has been found to impact the presence of physical symptoms. How people feel in control of their stress may also impact how physical symptoms manifest. The purpose of the study is to identify how the presence of chronic conditions may moderate the relationships between daily stress exposure and physical symptoms as well as between control over those stressors and daily physical symptoms. The Mindfulness and Anticipatory Coping Everyday (MACE) study, an online 8-day daily diary study, investigated the impact of daily stressors and chronic conditions on daily physical symptoms in 107 younger adults (aged 18-36) and 117 older adults (aged 60-90). Across both multilevel models, people with more chronic conditions reported more daily physical symptoms. In addition, on days when exposure to daily stressors increased, daily physical symptoms also increased. In contrast, on days when control over those stressors increased, daily physical symptoms decreased. These relationships did not vary by chronic conditions. These results suggest that having high levels of daily stress and lacking control of it worsen one's physical health. By decreasing and having more control over daily stressors, quality of life could improve and physical symptoms may decrease.

Assessing the Accuracy of Two-Dimensional CFD in Predicting the Effects of Cowl-Lip Position and Shoulder Rounding on a Mach 3.8 Supersonic Inlet

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Supersonic inlets slow and compress incoming supersonic air before it enters an air-breathing engine. Their performance depends on interactions between shock waves and the thin boundary layer of slower air along the inlet's surfaces. These shock-wave-boundary-layer interactions (SWBLI) can cause flow separation events, which are one of many precursors to inlet unstart and engine stall. Previous research shows inlet geometry influences these interactions, but predicting how design changes affect inlet performance remains challenging. This project aims to assess how accurately two-dimensional computational fluid dynamics (CFD) predicts the effects of cowl-lip position and shoulder rounding on inlet operation. These inlet geometry changes were demonstrated on a rectangular, three-ramp model designed for Mach 3.8. The cowl lip is located at the leading edge of the inlet's bottom surface opposite the compression ramps, while the "shoulder" is immediately downstream of the ramps. A baseline inlet and modified configurations will be evaluated using two-dimensional SolidWorks simulations and compared against experimental wind tunnel data and select three-dimensional simulations. Comparisons will examine inlet starting behavior, shock locations, surface pressure, and flow separation. Experimental data including schlieren imaging and select pressure measurements are used to visualize shock structures. The baseline geometry has been developed, and preliminary simulations have identified separation regions that motivated controlled geometry changes. Experimental validation is planned. The study will assess whether two-dimensional simulations predict both observed flow behavior and the relative performance between geometry configurations, clarifying when faster, simpler, simulations can support inlet design decisions and when three-dimensional analysis or experimentation is necessary.

The Effect of Time Pressure on Cognitive Interference

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Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Time Pressure and Accuracy on a Cognitive TaskTime limits are common in academic settings, but they may increase cognitive demands and reduce accuracy. Guided by cognitive load theory, this study examined whether time pressure affected performance on a brief cognitive task. Fifty-two adults completed either a timed or untimed Qualtrics task containing 29 cognitive items, followed by a stress questionnaire. The number of correct answers served as the accuracy measure. Participants in the timed condition (n = 28) answered fewer items correctly (M = 12.89, SD = 9.42) than participants in the untimed condition (n = 24; M = 25.88, SD = 7.12). An independent-samples t-test indicated a significant difference, t(49.29) = -5.65, two-sided p < .001. The mean difference was approximately 13 correct answers, representing a large standardized difference (Cohen's d = 1.54 in magnitude). These findings suggest that time pressure was associated with substantially lower accuracy on this task. The results contribute to research on how time constraints may affect performance in learning and assessment settings. Future analyses will examine whether the conditions also differed in response time and reported stress.

Print-to-Sense: Additive Manufacturing of Tactile Sensor Tiles

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With the rise of additive manufacturing technology for its ability to reduce material waste and the need for specialized equipment, it has become important for innovation. This project will focus on making piezoelectric tactile sensor tiles using PZT (lead zirconate titanate) powder and an additive binder jetting machine. The powder will be printed in layers with binder to create the "green body", then cured and sintered to create the final tiles. These types of tiles can be used for applications such as tactile sensor tiles, like the ones being made in this project, and energy harvesting devices, like floor tiles in busy areas, where pressure or movement can produce an electrical signal. The performance of the tiles will be tested by measuring the piezoelectric charge coefficient (d33), which shows how much electrical charge is produced when the material is pressed. The results will help determine whether PZT tiles made through the binder jetting process could be useful for sensing applications. Since this is a relatively new area of development there are very few papers on piezoelectric devices made from PZT using additive binder jetting.

Development of the Brain Cancer Care Team Caregiver Information Sheet for Patients and their Caregivers: A Community Engaged Approach

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Caregivers of patients with high-grade brain tumors experience significant emotional, physical, and logistical burdens while navigating complex multidisciplinary care. Many report limited knowledge of healthcare team members and supportive resources. This project evaluated a caregiver resource handout developed to address these informational needs. The handout was developed using feedback from caregivers and oncology nurse navigators across multiple specialties. The final handout included multidisciplinary care team roles, symptom management, emergency guidance, QR codes linking to caregiver resources, and a personalized notes section. Following completion of the PATH-BT survey, caregivers evaluated the handout using sliding scale measures to assess visual appearance, usefulness, accessibility, organization, and awareness of previously unknown care team members. Participants were also invited to provide open-ended comments. A total of 279 caregivers were invited to participate in the follow-up survey. Of these, 156 completed the survey, and 142 responses were included in the final analysis after data cleaning. Among analyzed responses, 102 caregivers completed the sliding-scale evaluation of items, and 123 caregivers provided qualitative feedback. Preliminary findings suggested that caregivers perceived the handout as a valuable and accessible resource that improved awareness of multidisciplinary care team members and available resources. The caregiver resource handout addressed an important informational need among caregivers of patients with high-grade brain tumors. This project addresses an important gap in caregiver education by providing centralized information about care team roles and supportive resources. Incorporating caregiver-focused educational materials into clinical practice may enhance caregiver preparedness and engagement with available resources.

Measuring the Diameter of Lemur Hair

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Hair varies in thickness and corresponds to changes in hair surface structure, length, and diameter. Hair diameter can vary along the length of a single hair. While examining lemur hairs under the microscope for another project, we noticed that some hairs appeared to fluctuate from very thick to very thin several times per hair. Therefore, we proposed to quantify the size of hair diameter fluctuations along the hair of three lemur species to gain insight into their function and evolutionary dynamics. We hypothesized that hair diameter patterns would vary significantly. Captive Sifaka (Propithecus coquereli) hairs were collected, placed on slides, and examined under a compound light microscope using 10x and 40x objective lenses and an AmScope MU1000-HS camera. Instead of using a reinvented trichocylcophore instrument as previously planned, overlapping photographs were taken along the length of each hair, the images were uploaded to ImageJ, and set to a micrometer scale. The length of the hair was taken first. Then the diameter of each hair was measured at three points; the midpoint and 10 um from the follicle and tip of the hair. Averages from ten hairs were: length, 255.789 um; base, 0.205 um; midpoint, 0.254 um; and tip, 0.162 um. Differences could be due to body plan, phylogeny, and/or habitat differences. Analyzing hair diameter fluctuations could yield insight into its function and evolutionary purpose. Future research should include examining hair diameter fluctuations across more lemur species.

Lip Syncs and Lifelines: How Drag Artists Foster LGBTQ+ Acceptance and Community

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For LGBTQ+ individuals, a protective factor from mental health challenges is being part of a community. Community belongingness involves inclusive spaces that value all members as their true selves, regardless of identity and background. One possible way to promote LGBTQ+ community belonging is through drag, a performance art popular in the LGBTQ+ community. This study uses data from a larger study of 31 drag performers across the United States and Canada. We are currently conducting reflexive thematic analysis to familiarize ourselves with the data. This will help us code the data and identify themes from the data. Two emerging themes from the data are that drag can be used to promote the acceptance of LGBTQ+ individuals, and that drag is one form of self-expression for LGBTQ+ people to experience joy and community. Participants talked about how they have used drag to create opportunities to educate others on LGBTQ+ issues. Participants also noted the historical significance of drag creating safe spaces for the LGBTQ+ community. These findings suggest that drag could be one way to promote the well-being and inclusion of LGBTQ+ individuals in society. One suggestion for future practice is that social workers and other professionals who serve the LGBTQ+ community work with drag performers in the creation, promotion, and execution of programming that pertains to LGBTQ+ individuals.

Nitrogen Concentration Dynamics in Coastal Waterfowl Impoundments

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Waterfowl impoundments are areas managed to create habitat and food for waterfowl through deliberate hydrologic and vegetation manipulation. Waterfowl impoundments have been identified as significant, yet understudied, sources of inorganic nitrogen to downstream bodies of water. This study aims to further quantify and validate the timing and level of inorganic nitrogen concentrations within two impoundment types: agricultural impoundments (AG) and moist-soil managed impoundments (MSM).Within Hyde County, our primary study area, more than 1,100 acres of impoundments drain into the hypereutrophic Lake Mattamuskeet. The quantification and validation of the nutrient dynamics within impoundment water will assist in identifying nutrient loads to the lake. By monitoring and analyzing the nutrient concentrations within impoundment waters, the contributions of the impoundments to impaired water quality can be examined. To assess nutrient dynamics, we monitored nitrate-nitrogen and ammonium-nitrogen concentrations (mg/L) within the two different impoundment types.Through our research, we were able to reveal that the highest concentrations of inorganic nitrogen occurred in April-June for the AG impoundment and Feb-May for the MSM impoundment. The primary factors that we found to affect inorganic nitrogen concentrations were fertilization, weather, pump management, and impact by waterfowl. Our findings indicated that waterfowl impoundments had lower nitrate-nitrogen concentrations than other agricultural lands but had comparable or greater ammonium-nitrogen concentrations to many other land uses, including agricultural areas near Hyde County. The findings from this study can be used to examine specific effects that waterfowl impoundments have on watersheds and steps to limit the continued eutrophication of Lake Mattamuskeet.

Satb1 and Satb2 form Homodimers and Heterodimers with Each Other

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Wingate University

Chromatin architectural proteins like Satb1 and Satb2 organize DNA into regions of hetero- and euchromatin, which aid in the control of gene expression. Satb1 is primarily involved in thymocyte development, while Satb2 plays a critical role in osteogenesis. These proteins are expressed in mutually exclusive differentiated cells, but both are present in embryonic stem cells, where their relative concentration is used as a redundant mechanism to determine self-renewal versus differentiation. This study aims to determine if these proteins are able to form homodimers and heterodimers with each other and whether the formation of dimers is dependent on DNA. To detect dimerization, we created EGFP and mScarlet3 tagged versions of each protein. The mScarlet3 fusions also included mutations that disrupted the function of the Nuclear Localization Sequence (NLS Null), which confines these proteins to the cytoplasm. We then co-expressed pairs of plasmids in HeLa cells. If dimers are able to form between the nuclear import-competent EGFP proteins and the NLS Null mScarlet3 proteins, then we expect to find mScarlet3 in the nucleus. Preliminary results suggest that both proteins are able to form homo and heterodimers.

Online First, Not Online Only

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Ally Bank is one of the largest online-only banks in the United States, but it competes for customers who have long relied on physical branches. Within a class-wide study of banking preferences, our project asks when, if ever, digital native consumers feel the need to visit an in-person branch, and what that means for an online-only bank's ability to attract and keep them. Prior research shows steady growth in mobile and online banking among younger consumers, while suggesting that many customers still value face-to-face service for complex or high-stakes decisions. Less is known about which specific situations still bring digital natives into a branch. To explore this, we added a question on branch-visit triggers to the class's anonymous survey, which will measure how much of the respondents' banking is done online, the importance of individual digital services, the information sources behind their choice of bank, reasons they would switch banks, and the specific situations that prompt a branch visit, along with demographics and open-ended views on online-only banks. We expect respondents to handle most routine banking online but still prefer a branch for complex financial decisions, personalized advice, and urgent issues such as fraud. These findings can help Ally Bank and other online-only banks identify the service gaps that tie consumers to traditional banks and design digital or hybrid solutions to close them.

Relationship between Tooth Replacement Rate and Tooth Size in Cichlid Fishes

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Teeth are mineralized structures located within the oral cavity that play a critical role in food acquisition and processing across vertebrate species. Proper regulation of tooth formation, spacing, and replacement is essential for maintaining functional dentition, and disruptions to these processes can contribute to craniofacial abnormalities in humans. Investigating the developmental mechanisms that influence tooth regeneration provides insight into both evolutionary adaptation and dental health. Unlike mammals, many teleost fishes continuously replace their teeth throughout life, making them valuable models for studying patterns of dental renewal.Cichlid fishes exhibit substantial diversity in dentition and feeding strategies, providing an opportunity to examine how tooth replacement dynamics vary among species. In this study, individuals derived from two cichlid species with contrasting dental phenotypes, Copadichromis azureus (CA) and Dimidiochromis compressiceps (DC), were used to investigate the relationship between tooth replacement rate and tooth size. Tooth replacement activity was quantified by counting newly mineralizing teeth identified through sequential vital staining techniques, while tooth size measurements were obtained from previously collected morphological data.By comparing patterns of tooth replacement with variation in tooth size, this study aims to determine whether species with larger teeth exhibit different rates of dental renewal than those with smaller teeth. Characterizing these patterns in cichlids contributes to a broader understanding of how tooth size and regeneration are coordinated in polyphyodont vertebrates and may provide insight into conserved mechanisms underlying vertebrate tooth development and replacement.

Project C.A.R.E. Community Engaged Research

Celia Gully

Mentored by: Caitlin Torrence

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Introduction: Informal caregivers provide much support enabling people living with dementia to remain in their communities, yet the availability of respite and other supportive services does not ensure their access or utilization. Project C.A.R.E. examines factors influencing dementia caregivers' experiences with supportive services in western North Carolina (WNC) and incorporates community expertise to inform locally responsive research and recommendations. Methods: A narrative evidence synthesis and literature landscape analysis examined caregiver burden, respite needs, service access, and rural determinants of service use, emphasizing applicability to WNC. Findings are informing development of a community-based participatory research (CBPR) advisory committee of caregivers and community partners with relevant lived and professional experience to guide research priorities, methods, interpretation, and translation. Results: Patterns from the narrative evidence synthesis and literature landscape analysis indicate respite service utilization is shaped by consistent barriers including a culture of independence, limited awareness of available resources, and significant geographic distance from services. This landscape analysis, in combination with guidance from the CBPR committee, will inform the development of study instruments. Research will begin with a quantitative survey distributed by community partners to assess caregiver experiences, followed by optional individual interviews to provide deeper insight into barriers and service needs. Conclusion: Survey data will be analyzed descriptively, while interview data will undergo thematic analysis. Findings will be interpreted collectively to develop policy recommendations aimed at improving access to respite services and supporting informal dementia caregivers in western North Carolina.

Evaluating Ecological and Economic Indicators of Durham Street Trees

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Urban forestry is framed as green infrastructure with measurable return on investment, yet patterns often mirror historical disinvestment in low-income communities. Durham, NC, is expanding its street trees, but whether the investment delivers equitable ecological and economic returns across historically redlined neighborhoods remains unclear. This study treats tree fecundity (seed/fruit production) as the main indicator for evaluating whether green investment advances community-level sustainability. Tree investments may function as inequitable resource allocation, delivering lower economic and ecological returns to historically redlined neighborhoods (neighborhoods where banks and governments systematically refused mortgages and investments based on poverty and race), while wealthier areas gain compounded benefits. We overlaid the Masting Inference and Forecasting (MASTIF) network tree fecundity data, USDA Durham Street Tree inventory, and HOLC redlining polygons on ArcGIS. Over 22,000 Trees were classified by 8 neighborhoods. Results showed historically redlined neighborhoods experiencing 32% lower fecundity, higher planting zones, and 51.55% lower annual economic returns per tree. Urban forestry in low-income areas relies on lower-quality stock and deferred maturity; these neighborhoods experience delays in green spaces while wealthier areas maintain high ecological dividends. This creates a gap in sustainable equity, where communities most in need of ecosystem services receive the least immediate value. Quantifying this disparity informs equitable resource models for urban forestry programs. This study reframes urban tree equity as an economic and community development indicator, identifying whether Durham green spending perpetuates historical market failures. Future directions include developing community-driven investment strategies that align with both ecological and economic returns.

GreenFlow LLC: Development of Biodegradable PHA-Based Menstrual Applicators for Sustainable Women's Health

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Conventional menstrual products rely heavily on petroleum-derived plastics that contribute to environmental pollution and long-term waste accumulation. Additionally, the quantification of heavy metals, particulate microplastics, and endocrine-disrupting contaminants in modern tampons highlights a potential exposure pathway through the highly absorptive vaginal mucosa, raising concerns regarding bioaccumulation and hormonal regulation. This research investigates whether polyhydroxyalkanoate (PHA), a biodegradable bioplastic produced through microbial fermentation, can serve as a sustainable alternative to traditional plastic tampon applicators while maintaining the durability, flexibility, and comfort required for consumer use. Previous studies have identified PHA as a promising material due to its biodegradability, biocompatibility, and mechanical properties comparable to conventional plastics. To evaluate its suitability, tampon applicator components were designed and prototyped using both CNC-machined compression molding and PHA-based 3D printing. Commercially available PHA formulations were assessed for manufacturability, dimensional stability, surface quality, structural performance, and scalability. Mechanical and biodegradation testing protocols based on ASTM standards were incorporated to compare prototype performance and environmental degradation characteristics. Preliminary findings suggest that PHA can produce smooth, functional applicator components while offering complete biodegradability in composting and marine environments. Compression-molded prototypes are expected to demonstrate superior structural uniformity and surface finish compared with 3D-printed alternatives. This research contributes to the growing field of sustainable biomaterials by exploring a practical pathway for replacing petroleum-based plastics in menstrual care products, with the potential to reduce plastic waste and advance safer, environmentally responsible innovations in women's healthcare.-

Joy, Art, and Community: How Drag Impacts Mental Health Among Its Performers

Lay Guy

Mentored by: Travis Scheadler

University of North Carolina at Charlotte

Drag has become an increasingly controversial subject in recent years. The myths and misinformation surrounding drag and its performers reinforce discrimination, which is known to exacerbate mental health disparities. However, little is known about the mental health and experiences of drag performers. This study explores the mental health of drag performers and the impacts drag has on their lives. A qualitative thematic analysis approach was used for this study where 31 drag performers completed semi-structured interviews. The interviews revealed primarily positive effects drag has on participants' mental health and well-being. Results showed drag can promote joy among performers. Drag was also explained as an art form among participants. Many described drag as a tool for authentic self-expression and creative freedom. Participants also emphasized the role drag has in building community. Any negative effects on the participants' mental health typically involved interactions of disapproval by audiences or family members, usually fostered by the political controversy and misinformation surrounding drag. Politics can influence mental health among many people and populations. It is important to understand how mental health is impacted by sociocultural contexts so that the appropriate resources and sources of support can be implemented within mental healthcare. By looking at drag performers, we can start to understand how to best support populations that are vulnerable to mental health challenges.

When Does Simplicity Win? Comparing Classical and Deep-Learning Methods for High Dimensional Portfolio Risk Management

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Mentored by: Lisa Schwartz

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This study examines whether deep learning based factor extraction methods provide more stable and predictive risk representations than classical linear methods in high dimensional equity portfolios. Factor models are widely used in portfolio risk management, and Principal Component Analysis (PCA) has long been used to capture common linear sources of variation. More recently, autoencoders have been explored as a way to identify nonlinear structure in financial data. Using monthly returns for 409 S&P 500 constituents from January 2016 through December 2025, this study compares PCA with a neural network autoencoder. Returns were standardized and divided into a training period from 2016 to 2022 and a testing period from 2023 to 2025. Performance was evaluated using out of sample reconstruction mean squared error at multiple factor dimensions. PCA consistently produced lower reconstruction error than the autoencoder, while its leading components captured meaningful market, sector, and growth versus value patterns. These findings suggest that the dominant structure in this dataset is largely linear and that greater model complexity does not necessarily improve portfolio risk representation.

False Positive Strongyloides Serology in Kidney Transplant Candidates

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In immunocompromised populations, such as transplant recipients, infection by the parasitic roundworm Strongyloides is of great concern because typical post-transplant drug regimens suppress the immune system, allowing the worms to rapidly reproduce in the intestines where they frequently burrow through tissues. This infection, strongyloidiasis is typically tested for in blood and stool. Unfortunately, both test types are considered somewhat unreliable. While stool tests are slightly more reliable, blood testing is more commonly administered because of its convenience and increased sensitivity. However, these tests are believed to frequently produce false positive results. The purpose of this project is to assess the frequency of false positive results from Strongyloides antibody tests. Patient data will be extracted from the electronic medical records of patients who were evaluated for kidney transplant at an Infectious Disease Clinic in 2022 and 2023. This deidentified data will be used to determine the instance of false positive results based on the absence of certain Strongyloides risk factors. This project will contribute to existing information on the reliability of these tests. These results seek to decrease unnecessary fear and testing and avoid extending time spent on the transplant waitlist for patients evaluated for kidney transplant.

G. bulloides size-depth distribution within an Oxygen Minimum Zone

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Mentored by: Sara Rutzky

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In Spring 2024, the NCSU Past and Present Lab collected foraminifera samples from 5 stations along California's southern coast. Abnormal depth distribution of foraminifera, Globogerina bulloides (G. bulloides), usually found above the Oxygen Minimum Zone (OMZ), was recorded with high abundance in the OMZ at multiple stations. A true depth habitat in the OMZ, downwelling, or viral mass mortality event are all hypotheses that could cause abnormal depth distribution. To distinguish among hypotheses, samples' tests were taken from station 5 at 9 depth intervals and measured using a Keyence microscope to determine maturity, using minimum and maximum diameter. Then an ANOVA was run to determine statistical significance of mean differences of size. Net 9, closest to the surface, where G. bulloides are most common, exhibited the greatest variance, with larger samples than would be seen in a regular distribution of G. bulloides. Nets 8, 6, 4, and 3, are significantly different from net 9, showing similar variability, while nets 7, 5, 2, and 1 displayed no significant difference from all others. The great variance of test size found in Net 9. In a true depth habitat, we would expect samples across all nets to have similar variance in test size. A more likely cause for abnormal depth distribution is a mass mortality event, like downwelling, where surface oxygenated water is pushed down to depth, caused by Ekman Transport. NOAA wind data taken from buoys during collection around the stations supports this hypothesis.

Improving the Processability of High-Performance TVT-based Polymers through Side Chain Engineering

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Mentored by: Jeromy Rech

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Fabricating an organic solar cell (OSC) with a conjugated polymer is especially advantageous due to their lower cost, mechanical robustness, lightweight and flexible nature. Part of the reduced cost is the solution processing which can print OSCs through a roll-to-roll process; however, the selection of solvents which are able to effectively dissolve conjugated polymers for this process are limited, primarily halogenated aromatic solvents which are severely problematic for the environment. The primary focus of this work is to explore how side chain engineering (i.e., modification of the long alkyl groups attached to the polymer backbone) can improve the processability and performance of polymer donors in OSCs. The objective is to develop a polymer that simplifies the synthetic pathway while maintaining high efficiency, addressing challenges in renewable energy technology. Specifically, we synthesized a series of derivatives of PTVT-T, an ester-substituted poly(thiophene vinylene) polymer, through a cost-effective five-step synthesis using low-cost raw materials. Additionally, modifying the side chains with long alkyl groups improves solubility in more eco-friendly solvents, reducing the need for hazardous processing conditions. This ensures that PTVT-T can be produced reliably, with high purity, and at a minimal environmental and monetary cost. This work into methods of improving the processability of the polymer contributes to the development of more sustainable organic solar cells.

Optimizing Porcine Granulocyte Isolation to Evaluate Inflammatory Injury in Ex Vivo Intestinal Machine Perfusion

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Mentored by: Caroline McKinney-Aguirre

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Intestinal transplantation is a final life-saving intervention for complete organ failure, yet destructive inflammatory cascades that occur during the transplantation process contribute to 48% five-year mortality rates for adult patients. Normothermic Machine Perfusion (NMP) aims to mitigate this by circulating warm, oxygen-rich blood through donor organs ex vivo, but the inflammatory mechanisms by which host white blood cells (WBCs) drive mucosal damage during perfusion remain undefined. Progress is bottlenecked because porcine neutrophils, an essential model for human transplantation, are highly fragile and routinely disintegrate under standard isolation protocols. This study evaluated a multi-variable isolation matrix combining two different density gradients (60/70% vs. 62/75%) across two diluent environments: a standard phosphate-buffered saline (PBS) salt solution and a nutrient-dense cell medium called DMEM. Following centrifugation and a lysis buffer, target cell fractions were validated utilizing automated cell counting, light and immunofluorescent microscopy, and flow cytometry. The DMEM and 62/75% gradient successfully maximized both purified granulocyte yield and 48-hour viability. Cell counting demonstrated that while PBS causes low cell viability, DMEM preserved cell integrity across 2 days. Furthermore, light microscopy and flow cytometry confirmed that these optimized layers successfully isolated structurally intact granulocytes and lymphocytes within their designated fractions. Although this project addresses a major barrier, it is limited by its dependency on immediate fresh donor blood, which is not always readily accessible. This project enables future studies to model real-time immune-mediated tissue damage, and subsequently research solutions to protect the donor graft during machine perfusion.

Upcycling Contaminated Waste: Co-Pyrolysis of Agricultural Plastic Mulch and Crop Residues

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Mentored by: Hui Li

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In response to rising production costs and stagnating selling prices, many small- and medium-sized commercial vegetable farms in North Carolina turned to plasticulture systems. While this practice has been shown to increase crop yields and shorten harvesting times, plasticulture also generates thousands of tons of plastic mulch waste annually statewide. These polyethylene plastic mulch films are often difficult to recycle due to contamination from use, resulting in them either being landfilled or openly burned. This increases farmers' disposal costs and contributes to air and groundwater pollution. North Carolina farmers also generate a comparatively larger tonnage of dry agricultural residues, such as cotton stalks or strawberry stalks, with upcycling potential. This research explores the sustainable reuse of dry agricultural waste and plastic mulch films through co-pyrolysis. Feedstocks are characterized with thermogravimetric analysis, proximate analysis, calorimetric analysis, Fourier transform infrared spectroscopy, biomass compositional analysis, and elemental analysis prior to pyrolysis. Following pyrolysis in an inert nitrogen atmosphere, biochar, bio-oil, and gases will have their yields, chemical compositions, and physical properties evaluated. We expect to observe a positive relationship between an increase in the plastic:biomass feedstock ratio and both bio-oil yield and biochar porosity. The outcomes of this research will contribute to scalable biomass waste upcycling techniques that can support rural economies, increase bioenergy access and abundance, and bolster bio-based supply chains.

Examining Changes in Affective Attitudes Toward Physical Activity Following Episodic Future Thinking and Positive Affect Guided Imagery Interventions

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Mentored by: Sarah Levens

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Physical activity is a cornerstone of human health; however, nearly one-third of the global population does not meet recommended guidelines. Physical activity provides cardiovascular and mental health benefits, improving overall well-being and reducing chronic disease risk. Addressing the lack of targeted interventions that increase motivation and cultivate positive attitudes can benefit wellness. Two approaches are Episodic Future Thinking (EFT) and Positive Affective Imagery (PAI). EFT involves imagining and mentally experiencing specific future events, while PAI involves vividly visualizing positive, emotionally meaningful experiences. Although these interventions could help promote exercise, their effects on affective attitudes toward physical activity are insuffiently researched. This study asks: To what extent do EFT and PAI interventions influence affective attitudes toward physical activity over 6 weeks? The 155 participants (72.9% female, 71.6% White) received EFT, PAI, or both intervention components via audio recordings before weekly in-lab exercise sessions. A paired-samples t test showed that, on a 0-7 scale, the average change in affective attitudes from baseline to Week 6 was not statistically significant, nor were the changes within the EFT-only, PAI-only, and EFT + PAI groups. However, the control group, which received neither intervention, showed a statistically significant decrease. Although the interventions did not produce statistically significant increases in affective attitudes, their lack of decline suggests EFT and PAI could maintain positive exercise attitudes, supporting physical health, mental health, and wellness.

Caring for Men Who Care: Moral Injury Levels in Men in Caring Professions

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Mentored by: Braveheart Gillani

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Moral injury is persistent psychological distress that arises when an individual's experiences conflict with their sense of goodness and morality in themselves, others, and institutions. Moral injury is a relatively newly defined concept, and research has focused mainly on military service members and healthcare workers. Previous research suggests that moral injury in healthcare workers is created from repeated small events tied to understaffing, high patient loads, and conflicts between ethical codes and business models. Caring for Men Who Care, a mixed-methods study in Charlotte examining men's participation in caring professions, includes a scale to measure moral injury among men. This analysis tested whether moral injury differs between men in healthcare and men in other caring professions, hypothesizing higher moral injury among men in healthcare. With a sample of 102 men, bivariate analysis indicated no significant differences in any item (all $p>.10$), suggesting that there is no difference between the two groups' levels of moral injury. The lack of difference suggests moral injury research should continue to extend to a broader range of caring professions. Additionally, the current moral injury scale may need to be adapted from military personnel to civilians. Future moral injury research should focus more on caring professions with larger samples and focus on raising awareness of moral injury in men so they can recognize it in themselves.

Mapping Prejudice, Guilford County

Juleigh Harris, Monica Miller, Lucas Mendoza-Gonzalez

Mentored by: Paul Ringel

High Point University

Throughout the course of a semester, we have partnered with Mapping Prejudice to conduct research on the prevalence of racially restrictive covenants in Guilford County, North Carolina. Mapping Prejudice is an organization based in Minnesota that researches, records, and maps the racially restrictive covenants found in many deeds of sale dating from around 1910 to 1968, when they were eventually banned due to the enactment of the Fair Housing Act. These racially restrictive covenants became a popular addition to many property deeds, preventing black and non-white individuals from purchasing or occupying a given plot of land. We plan to conduct a panel in which we will explain what racially restrictive covenants were, how and why they were used, in what ways they affected the lives of black Americans, as well as their broader impact and implications. We will guide the audience through the history of the racially restrictive covenants and will lead a conversation on their significance, highlighting the historical and cultural influence they had on America.

Characterization of Ge and GeSn samples via Photoluminescence Spectroscopy

Daniel Harris

Mentored by: Jay Mathews

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Optoelectronics is the intersection of optics and electronics, which has numerous applications including telecommunications, medicine, and neural networks. The electronic chips of everyday devices are created from silicon (Si), and the infrastructure to manufacture them is well established. However, due to some physical properties of Si, it is not viable for making lasers in the infrared (IR) spectrum commonly used in optoelectronics. Germanium (Ge) and its alloys with tin (Sn), called germanium-tin (GeSn), have been demonstrated to emit light in the IR spectrum at room temperature. These materials are also compatible with the processes used to create Si electronics. This makes Ge and GeSn promising materials for creating laser components on Si. A current challenge with these materials is structural defects, which are often difficult to observe experimentally, with some being a single atom in the wrong place. These defects can make it more likely for energy to be lost as heat rather than emitted as light, which significantly reduces the overall amount of light emitted. Our work involves analyzing Ge and GeSn samples with varying Sn content that have undergone different preparation and processing methods. We accomplish this via photoluminescence (PL) spectroscopy, where a sample is illuminated with a laser and the intensities of the resulting wavelengths of light emitted by the sample are recorded. This allows us to observe the effects of changes in Sn content, processing, and preparation methods on the emission of light, giving insight into the defects within our samples.

AI Chatbots and Self-Criticism: Comparing the Impact of Human vs. Artificial Feedback

Sawyer Harrold

Mentored by: Laura Nagy

High Point University

AI chatbots such as ChatGPT are increasingly used for friendship, coping with loneliness, self-image concerns, and symptoms of depression and anxiety, yet how these interactions affect the way people think about themselves is largely unknown. Self-criticism, characterized by harsh judgments of one's own worth, ability, or performance, contributes to a range of mental health difficulties, and people are increasingly turning to AI for reassurance and validation. The present study investigates whether feedback from an AI chatbot influences self-critical thoughts differently than feedback from a human. Participants recruited from the psychology department's research participant pool will complete a baseline measure of self-criticism, then attempt a task described as easy but designed to be partially impossible. Participants will be randomized to receive positive/affirming or negative/critical feedback from either an “AI system” (pre-written immersive script) or a trained research assistant, then complete the self-criticism measure again, and differences across the four conditions will be analyzed. It is hypothesized that critical AI feedback will heighten self-criticism, while affirming AI feedback will reduce self-criticism more effectively than similar human feedback, potentially due to the AI's perceived objectivity. Findings will address a gap in empirical research and help begin to clarify whether AI interactions may be helpful or harmful to how people view themselves.

Ally Gen Z Study

Evan Hart, Alice Bianca Wettel, Daniella Ngongo

Mentored by: Steven Cox

Queens University of Charlotte

This study investigates what keeps Gen Z consumers from switching banks to help Ally Bank develop strategies to attract this segment. The central research question asks whether barriers such as the inconvenience of moving accounts or simple satisfaction with their current bank best explain Gen Z's reluctance to change banks. Earlier research on bank switching has linked loyalty, switching costs, trust, and digital convenience to Gen Zs' hesitation to switch banks. Few studies examine how these factors work together among Gen Z, a group that is only beginning to make independent financial decisions. This study uses a survey of Gen Z to measure the relative importance of switching barriers, as well as focus groups to explore the reasons behind those attitudes in greater depth. These findings will give Ally Bank practical guidance for designing offers, onboarding, and messaging that reduce friction, and will add to the broader understanding of financial loyalty among young adults.

Comparison of Dry Needle Placement Across Examiners with Varying Levels of Needling Experience: A Pilot Evaluation

Brianna Harvey

Mentored by: Nathan Savage

High Point University

Injection procedures are commonly used for diagnostic and therapeutic purposes, with providers using palpation-based landmark guidance or image guidance such as ultrasound. Previous research has primarily examined injection techniques, imaging guidance, treatment effectiveness, and adverse events, while provider experience and training are less frequently reported. This pilot study investigated whether external needle placement geometry differed between an early-career and expert provider during dry needling procedures and whether differences varied by body region. Two licensed physical therapists certified in dry needling, one with less than 3 years of clinical experience and fewer than 100 needling treatments and one with more than 3 years of experience and more than 1,000 treatments, performed palpation-based needle placement in 15 asymptomatic adult participants. Participants received bilateral needling of three elbow and three hip targets. Needle placement geometry was measured using ImageJ, and generalized linear mixed modeling was used to compare geometric areas while accounting for repeated observations. Of 270 needle locations, 232 (86%) were successfully visualized. No overall difference in needle placement configuration was found between providers; however, a significant interaction between provider and body region was observed ($P = 0.075$). These findings suggest that provider experience may influence needle placement geometry depending on body region. Further research with larger and more diverse samples and additional provider types is needed to better understand how provider experience and patient morphology may affect procedural accuracy, safety, and effectiveness.

Should Some Chemotherapeutics Be Taken with Food? Investigating the Role of Bile in Drug Absorption and Gastrointestinal Toxicity

Sophia Harvey

Mentored by: Aadra Bhatt

University of North Carolina at Chapel Hill

Many life-saving cancer medications come with serious gastrointestinal (GI) toxicities. For example, dasatinib, a chemotherapeutic used to treat chronic myeloid leukemia, causes chemotherapy-induced diarrhea (CID) in 28% of users. CID can sometimes reach life-threatening levels, yet few effective treatments exist, necessitating novel approaches. Pharmacomicrobiomics provides a new lens to tackle this issue. This field investigates how gut microbes influence drug absorption, distribution, metabolism, and excretion (ADME). A key mediator of drug-microbe interactions is the digestive fluid bile and, relatedly, bile acids, detergent-like compounds in bile that help emulsify fatty substances. Because gut microbes modify bile acids, one way microbiota can influence drug ADME is by altering bile composition. Our lab has recently found that bile offers protection against dasatinib-induced intestinal damage. Investigating further, this project aimed to uncover the mechanism by which bile offers protection and how altering bile composition affects the intestinal barrier. Using human-derived primary ileal cells and cell-based assays of viability and barrier integrity, we show that bile acids are essential for protection against dasatinib but only when incorporated into bile. Because bile is released in response to a meal, these findings suggest that it may be beneficial to take dasatinib with food to protect against adverse GI side effects. This work also provides a foundation to uncover novel strategies to reduce chemotherapy-induced intestinal damage, potentially through foods or supplements that change microbial and bile acid compositions.

The Effects of Time Constraints on Moral Decision Making

Tianna Haskett

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Time constraints may influence decision-making performance as well as individuals' psychological experiences while making decisions. This preliminary study examined whether time constraints affected decision-making outcomes and subjective experiences during a decision-making task. Twenty-nine participants were assigned to either a 2-minute-and-30-second condition (n = 16) or a 45-minute condition (n = 13). Participants completed a decision-making task and reported their confidence, emotional discomfort, perceived difficulty, decisional conflict, pressure, adequacy of time, and stress. Independent-samples t-tests indicated no significant difference in overall decision-making scores between the 2.5-minute (M = 6.31, SD = 2.80) and 45-minute (M = 6.69, SD = 2.93) conditions, p = .724. However, participants in the shorter time condition reported feeling significantly more torn between choices (M = 3.31 vs. 2.46), p = .030, and greater stress (M = 3.06 vs. 1.85), p = .003. Participants in the 45-minute condition reported significantly greater perceptions of having enough time to think (M = 3.92 vs. 2.19), p = .003. These preliminary findings suggest that time constraints may influence the subjective experience of decision making, particularly stress and decisional conflict, even when overall decision-making performance is not significantly affected.

Artificial Intelligence Powered Autonomous and Distributed Multi-Drone Platform

Madison Hasley

Mentored by: Ran Zhang

University of North Carolina at Charlotte

Autonomous multi-drone networks offer strong potential for distributed monitoring and real-time decision-making, but small battery capacities limit their operational lifespan. Wireless charging pads could remove the need for human intervention, but only if drones can land on them with minimal horizontal offset from the pad center. Building upon ongoing research in autonomous, distributed multi-drone systems, this work investigates whether a low-cost, onboard vision and flight control model can achieve precise physical landings on stationary and mobile charging stations. A custom quadcopter was integrated using a Pixhawk 6C flight controller, an Arduino Giga R1 microcontroller, and a Pixy2 vision sensor communicating via MAVLink telemetry protocols. The method combines real-time color signature tracking with block-size thresholds and temporal persistence frame counters to reduce false detections from ambient lighting glare and confirm target centering. Once the target is locked, the system rotates the drone to the desired heading and begins a controlled landing sequence. Initial field tests demonstrated functional real-time tracking and successful execution of flight commands, including autonomous operation in guided mode. Next steps include measuring landing offset and testing moving pads. This work is a foundational step toward continuous wireless power transfer for self-sustaining multi-drone networks.

What Executives Don't Say: Predicting Guidance Cuts from Earnings Call Language

Yaz Hathiram

Mentored by: Rayn Sakaguchi

North Carolina School of Science and Mathematics

Earnings calls combine two distinct modes of communication: scripted prepared remarks and unscripted analyst Q&A. This project investigates whether the language executives use across these two modes, specifically hedging and uncertainty language such as "we believe" or "cautiously optimistic," predicts whether a company issues a negative guidance revision in the following quarter. Prior research in financial text analysis has shown that linguistic tone carries information beyond a company's stated financial results, suggesting language itself may function as a leading indicator. This project focuses on the Industrials sector, which issues guidance regularly, comparing large-cap and mid-cap companies from 2018 to 2024 to test whether any signal is stronger where fewer analysts provide coverage. For each company, earnings call transcripts are collected and separated into prepared remarks and Q&A, then scored using the Loughran-McDonald financial dictionary. Guidance outcomes are pulled from subsequent 8-K filings and merged with transcript scores into a company-quarter panel, allowing a test of whether hedging language in a given quarter predicts that same company's guidance change in the next. Expected findings will indicate whether management's language anticipates financial outcomes before they are formally announced, and whether this effect differs by company size. If a measurable relationship exists, it would suggest that earnings call language carries predictive value independent of the reported financial data itself, with implications for how markets process qualitative information.

Resurrecting Camp Greene: Digital History of WWI Charlotte

Jack Hayes

Mentored by: Heather Perry

University of North Carolina at Charlotte

Camp Greene did more than train soldiers for World War One, it helped transform Charlotte's economy, landscape, and community. Organized and established in 1917, the U.S. Army training camp brought thousands of soldiers from across the country to Charlotte, and in turn created new opportunities for local businesses in the city. The research for the project this semester examines how Charlotte businesses reacted to the creation of the camp and how this influx of troops contributed to the city's development in the early 20th century. For my research, I analyze camp published newspapers page by page, notably Trench and Camp. Through the study of the advertisements of local businesses operating near the camp, I can understand what goods they offered and the methods of targeting troops as customers. Once I have sufficiently understood and cataloged all the businesses and their information, I will use original city directories to locate where these businesses were and establish their relationship to the camp and surrounding area. Geographic information system (GIS) software will be used to help visualize their locations in respect to the camp and Charlotte's developing landscape. This research is a segment of the much larger digital history project dedicated to reconstructing the history of Camp Greene and the surrounding 1910s Charlotte through archival research, historical mapping, and digital tools. By combining all these methods of historical research, this project seeks to create a comprehensive understanding of Camp Greene's impact socially, economically, and geographically in the development of modern Charlotte.

Humanity and Artifice: How Jane Austen's Fictional Letters Pair Artificiality with Virtue

Kathryn Helms

Mentored by: Hudson Vincent

Davidson College

Literary scholars have long wrestled with the meaning of Jane Austen's fictional letters. Some scholars, building off an influential essay by Ian Jack, have explored these letters as characterization tools that reveal unfavorable and unvirtuous traits. Still others have interpreted those letters as directly challenging the common 18th century sentimental assumption of authentic interiority in the epistolary genre: By allowing characters to lie, conceal, and reframe events, Austen uses the intentionally crafted nature of the letter to underscore duplicity and hypocrisy. Letters by more virtuous characters are explained by scholars such as Norman Page as functioning for exposition rather than characterization. However, this paper argues that a close reading of the letters of Mr. Darcy in Pride and Prejudice and Captain Wentworth in Persuasion reveals written displays of virtue that function not as mere exposition, but as forms of positive characterization. This does not contradict Austen's emphasis on the letter as an artifice, nor does it undermine her rejection of 18th century sentimental clichés, but rather shows how Austen's fictional letters highlight that intentionality of communication is not inherently deceptive and duplicitous, but a natural and unavoidable part of humanity, challenging the negative connotation of "artificiality." In a modern era of rapid technological advancements and controversy surrounding artificial intelligence, it is particularly relevant to revisit foundational and influential works of fiction, such as the novels of Jane Austen, that explore the relationship between artifice and humanity and what it means for a human creation to be authentic.

Greenhouse Production and Management of Poinsettias.

Bryson Helton

Mentored by: Diane Mays

North Carolina State University

Poinsettia (Euphorbia pulcherrima) account for nearly one-quarter of all potted plants sold annually in the United States, generating roughly $250 million. Production requires coordinated cultural and nutritional management throughout the greenhouse production cycle to produce healthy, marketable plants. This project examines the greenhouse production of two poinsettia cultivars, 'Alaska White' and 'Mars Late Red,' with an emphasis on the management practices used throughout crop development. Production activities include crop establishment and maintenance, pinching, irrigation management, fertilizer preparation and application, nutrient treatments, and monitoring of substrate pH and electrical conductivity using the Pour-Thru method. Fertilizer solution and irrigation-water conditions are also monitored to help guide management decisions during production. Observations and measurements are recorded throughout the growing period to document crop development and changes in root-zone conditions alongside fertility practices. Expected results include successful development of both cultivars through the production cycle and a clearer understanding of how irrigation, fertility management, and substrate monitoring work together in greenhouse poinsettia production. This project provides an applied examination of commercial-style production and demonstrates the importance of integrating plant growth practices with regular nutritional and environmental monitoring to support crop quality and informed greenhouse management.

Effect of Feedback on Performance of Math Problems in College Students

Madison Henderson

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Feedback may affect how students approach a subsequent academic task. This study examined whether positive feedback, negative feedback, or no feedback following an initial set of math problems was associated with performance on a second set and with students' reported confidence, anxiety, and motivation. Thirty-nine participants completed two sets of 10 math problems. After the first set, 18 received positive feedback, nine received negative feedback, and 12 received no feedback. Scores on the first set did not differ significantly across groups, $F(2, 36) = 1.53$, $p = .229$. Scores on the second set differed, $F(2, 36) = 6.41$, $p = .004$. The positive-feedback group averaged 6.44 correct answers ($SD = 3.70$), the negative-feedback group averaged 6.78 ($SD = 3.53$), and the no-feedback group averaged 2.67 ($SD = 1.44$). The two feedback groups did not differ significantly from each other, while each scored higher than the no-feedback group in adjusted pairwise comparisons. Group differences in reported math confidence, anxiety during the second set, and motivation were not statistically significant. These findings suggest that receiving feedback, regardless of whether it was positive or negative, may be related to performance on a subsequent math task. Further work could examine how feedback content and task difficulty contribute to this pattern.

Evaluating the Antibacterial Efficacy of Neat Botanical Oils Against Staphylococcus aureus

Rachel Henninger

Mentored by: Marguerite Bishop

Gaston College

Staphylococcus aureus is an opportunistic skin bacterium that maintains symbiotic roles but can cause severe localized or systemic infections upon host entry. Historical populations across cultures have long used traditional botanical remedies to manage bacterial threats. Addressing contemporary antimicrobial resistance challenges, this study evaluates the comparative antibacterial efficacy of five neat essential oils against Staphylococcus aureus: garlic (Allium sativum), oregano (Origanum vulgare), ginger (Zingiber officinale), tea tree (Melaleuca alternifolia), and clove (Syzygium aromaticum).Antibacterial susceptibility will be assessed using a standard disc diffusion assay. Nutrient agar plates will be uniformly inoculated with a standardized Staphylococcus aureus suspension to form a bacterial lawn. Sterile filter paper discs saturated with the respective neat essential oils will be placed onto the plates. To ensure reproducibility, five independent experimental replicates will be conducted.Plates will be incubated at 37°C for 48 hours. Antimicrobial efficacy will then be quantified by measuring the zone of inhibition diameters in millimeters. Experimental groups will be compared against positive controls (tetracycline discs) and negative controls (untreated blank discs), with quantitative data analyzed using one-way ANOVA.Anticipated findings project that high-potency oils will generate substantial inhibition zones comparable to standard antibiotics, offering valuable baseline data on plant-based extracts as prospective natural antimicrobial agents.

Co-Application of Kudzu-derived Biochar and Bacillus velezensis Synergistically Mitigate Salt Stress in Setaria italica via Rhizosphere and Plant Mechanisms

Colin Henry

Mentored by: Jennifer Williams

North Carolina School of Science and Mathematics

Coastal salinization threatens agricultural productivity worldwide, including in the Philippines. This issue has created demand for salt-tolerant crops like Setaria italica (foxtail millet). However, while the cereal is more salt-tolerant than rice, it still experiences substantial ionic disruption under salinity, demonstrating the need for complementary interventions. Two interventions include biochar and Plant Growth-Promoting Rhizobacteria (PGPR). These have been demonstrated to independently and synergistically confer salt tolerance to many cereals, but the mechanisms behind their synergy remain poorly resolved and may depend on feedstock, PGPR strain, and plant. This study aims to identify whether slow-pyrolysis kudzu-derived (Pueraria montana var. lobata) biochar (KDB) interacts with Bacillus velezensis strain GB03 (a model PGPR strain conferring salt-tolerance across diverse hosts) to improve salt-tolerance in S. italica through complementary rhizosphere and plant mechanisms. KDB characterization revealed a pH of 9.565, EC of 1548.013, bulk density of 200.9 kg/m^3, and ash content of 9.70%. Furthermore, groups have been designed to change salinity, KDB amendment, and seed inoculation. Rhizosphere pH, EC, Na/K, and CFU analysis will characterize the growing environment; root RT-qPCR will assess salt response-related pathways; plant tissue Na/K and biomass will quantify physiological outcomes. It is hypothesized KDB will increase rhizosphere bacterial presence through superior ion availability and favorable growing conditions, which will synergize with GB03's improvements on ion regulation. Thus, co-application will bring increased ionic balance and biomass. This study provides insight into co-application of biochar and PGPR to mitigate salt-stress through mechanistic combination.

Black Liberation Theology; A Synthesis of Black Christianity and Black Power in the Civil Rights Movement

Titus Henry

Mentored by: Aaron Hooker

University of North Carolina at Charlotte

Historical records indicate a strong influence of Black Christian theology in the fight for Black Liberation during the Civil Rights Movement and beyond. The focus of this research is to examine how the doctrine of Black Liberation Theology developed as a means of synthesizing the message of the Christian Gospel with the Black Power movement's philosophy of liberation and self-autonomy for African Americans. Through an analysis of theological and political texts from key figures such as James Cone and Martin Luther King Jr., this literature review seeks to examine the ways in which these theological practices were carried out in Black communities across America, and observe how scholarly critique of the movement helped its practitioners to address internal shortcomings so that they could better meet the needs of their respective communities. The broader contribution of this research is to help better contextualize the role that spirituality and religion has played in shaping social justice initiatives, along with identifying historical frameworks and measures that have been effective in advancing the goal of Black Liberation.

Active Learning Approaches in Undergraduate Chemistry and Their Effects on Student Learning and Motivation

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Mentored by: Kimberly Buch

University of North Carolina at Charlotte

Traditional lecture-based instruction in undergraduate chemistry can make it difficult for students to remain engaged, motivated, and actively involved in learning, especially in large-enrollment introductory courses. Active learning approaches have emerged as an alternative to passive lecture-based instruction, but the effectiveness of specific strategies may vary depending on the learning environment, course structure, and student population. The focus of this literature review is to examine the types of active learning strategies used in undergraduate chemistry and how these strategies influence student engagement, motivation, and learning outcomes. Peer-reviewed research published primarily between 2014 and 2025 was synthesized, with earlier foundational research included to provide historical context. The literature examined a range of approaches, including Process-Oriented Guided Inquiry Learning (POGIL), Problem-Based Learning (PBL), Distributed Active Learning (DAL), Active Learning Studios, and technology-enhanced strategies such as 3D models, formative assessment tools, and gamification. The literature demonstrates that active learning is associated with improved student engagement, conceptual understanding, and academic performance compared with traditional lecture-based instruction. However, findings related to student motivation and technology-enhanced approaches vary depending on factors such as task complexity, course content, classroom structure, and implementation. Structured and collaborative approaches may also help reduce achievement gaps among historically underrepresented and first-generation students. The overall contribution of this literature review is to synthesize how different active learning approaches can be adapted to diverse undergraduate chemistry learning environments and to identify factors that may influence their effectiveness.

Phage Hunting: Isolation of Novel Pseudomonas Bacteriophages

Michelle Hernandez

Mentored by: Amanda Rushing

Catawba College

Antibiotic-resistant bacterial infections are an increasing global health concern, particularly infections caused by Pseudomonas aeruginosa. Carbapenem-resistant P. aeruginosa is especially problematic because carbapenems are considered to be a last line therapy for treating multi-drug resistant infections. Bacteriophage therapy offers a promising alternative to traditional antibiotics because phages can specifically target antibiotic-resistant bacterial pathogens while minimizing the disruption of beneficial microbiota. My project aims to isolate and characterize Pseudomonas-specific bacteriophages from freshwater environments on the Catawba College Ecological Preserve. Aquatic sediment samples will be screened for phage activity using Pseudomonas putida as a model host. Putative phages will be purified, and their genomes characterized through MinION whole-genome sequencing. Isolation and characterization of these phages will expand local phage collections and contribute to ongoing research into bacteriophage-based approaches for addressing antibiotic-resistant bacterial infections.

Comparison of Antimicrobial Substances Present in Varying Levels of Soil Disturbances

Anna Hernandez, Momo Kong, Mac Looney

Mentored by: Chasity Moore

South Piedmont Community College

Microbes often produce antimicrobial substances to help them better compete with other microbes for resources in their environment. Such antimicrobial substances aide in the development of antibiotics used in healthcare and agriculture to combat human, animal, and plant disease. Our objective is to discover novel antimicrobial activity within bacterial species taken from soil samples from varying levels of substrate disturbances. We expected to observe more antimicrobial activity against alternative safe strains of ESKAPE pathogens that are exposed to newly discovered antimicrobial agents in undisturbed soils compared to more disturbed soils. The effectiveness of the antimicrobial substances produced by isolated bacterial species will be tested utilizing methods outlined by established Tiny Earth protocols. These newly discovered antimicrobial substances will contribute to a growing collection of chemical isolates being compiled at The University of Wisconsin to combat the growing issue of antibiotic resistance.

Antimicrobial Activity, Biofilm Inhibition, and GC-MS Profiling of Origanum vulgare (Oregano) Against Clinical Isolates of Bacteria

Karem Hernandez

Mentored by: Akamu Jude Ewunkem

Winston-Salem State University

Background: Multidrug-resistant pathogens cause millions of annual deaths, creating an urgent need for alternative antimicrobial agents. Plant extracts like oregano (Origanum vulgare) show broad antimicrobial properties, yet their specific effects on clinical bacterial and yeast isolates remain largely unstudied. Objectives: This study investigates the antimicrobial efficacy of oregano against a diverse panel of clinical bacterial isolates. Methods: We evaluate the inhibitory activity of oregano extracts and test their impact on biofilm formation in these clinical strains. Gas chromatography-mass spectrometry (GC-MS) is utilized to profile and identify the specific bioactive compounds present in the herb. Furthermore, this panel of clinical isolates will be sequenced to detect the presence of resistance genes. Significance: The findings provide actionable insights for the healthcare and pharmaceutical sectors seeking plant-based alternatives to combat drug-resistant microbial infections.

Why Can't I See You? Coloristic Ideology Through Media in Mexican Culture

Melissa Hernandez Rojas

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Media-driven beauty standards rooted in coloristic ideology are shaping self-perception and social experiences of younger generations in Mexico. Skin tone is used to measure desirability, modernity, and socioeconomic mobility. Repeated exposure to Eurocentric beauty ideals contributes to internalized colorism, psychological harm, and the normalization of discriminatory attitudes within peers. This work seeks to identify and analyze the detrimental effects of coloristic ideology through the frames of media representations, focusing on advertising, films, and social media platforms in Mexican media produced and disseminated from 2016 to 2026. This examination will assess historical racial stratification while analyzing how emerging generations' understanding of identity, belonging, and social value are informed by the intentional and unintentional integration of Eurocentric ideology into Mexican culture.

Mental Health and Athletic Performance: The Impact of Therapy on Athletes

Megan Hobbs

Mentored by: Jen Blush

William Peace University

Struggling with mental health as a student athlete can mean that academic and athletic performance can suffer, which has been shown consistently in previous research (Mack et al., 2023). Prior research has been conducted to address this concern. Kilcullen et al. (2022) reported treatment-seeking athletes showed improved mental health outcomes and better athletic performance compared to their peers who did not seek help. The current research aims to further investigate the impact of therapy on athletic performance, with a focus on the mental health challenges athletes face. The participants are athletes from small, private universities in Raleigh, North Carolina. All are current members of either a men's or women's varsity sports team. The study assessed psychological strain using the Athlete Psychological Strain Questionnaire (APSQ), and athletic performance was self-assessed through the Sport Performance Perceptions Scale (SPPS). Results demonstrated that SPPS scores did not differ significantly for athletes who were in therapy vs. not; however, there was a significant difference shown for the ASPQ scores ($p = .02$). Athletes who are in therapy report greater psychological strain than those who are not in therapy, suggesting that being in therapy may lead to awareness of issues, which could temporarily increase psychological strain until proper coping strategies are learned. Even though our results did not support our hypothesis, the results still speak to the importance of incorporating mental health resources into athletic training programs. The mental health of our athletes is just as important as their physical health.

Enhancement of Plasma-Wave Resonance in GaN HEMTs through Dispersive Ferroelectric Gate Dielectrics

Lincoln Hogan

Mentored by: Lincoln Hogan

North Carolina State University

Dyakonov–Shur (DS) plasma oscillations in GaN high electron mobility transistors (HEMTs) have been widely studied for frequency-selective terahertz (THz) detection, yet small-signal plasma perturbations remain strongly attenuated due to weak gate-channel coupling and finite carrier momentum relaxation time, limiting resonance selectivity and observability. This work presents a first-principles framework for plasma-wave resonance enhancement through a dispersive ferroelectric gate dielectric in a GaN HEMT cavity. Plasma-wave dynamics are modeled via a modified DS equation incorporating a frequency-dependent effective gate capacitance derived from the Landau free energy landscape and Landau–Khalatnikov polarization dynamics. Ferroelectric parameters span experimentally reported ranges, capturing fabrication-induced variability in crystalline quality and film properties to ensure experimentally realizable predictions. High-frequency model behavior is validated against reported literature. We identify stable operating regimes and characterize how ferroelectric phase lag modifies plasma-wave propagation, cavity phase matching, and standing-wave reinforcement. Simulations predict order-of-magnitude increase in channel response and resonance Q-factor at phase-matching channel length determined by ferroelectric properties. Channel-potential heatmaps and round-trip phase analysis indicate that the enhancement originates from localized phase-coherent regions where ferroelectric dispersion satisfies cavity phase-alignment conditions, reinforcing standing-wave confinement. We demonstrate that the resonant frequency and associated enhancement length scale are predictable through the modified DS formalism, providing a framework for experimental implementation of ferroelectric-integrated HEMT cavities. This framework provides an analytical basis for ferroelectric-gate engineering in GaN HEMT cavities and identifies dispersive phase lag as a mechanism for selective plasma-wave reinforcement in otherwise heavily damped devices, motivating experimental realization of ferroelectric-integrated THz resonator platforms.

In Silico Evaluation of Amyloidogenic Features in Neurodegeneration-Associated Prion Proteins

Anna Holcombe

Mentored by: Kyung-Hoon Lee

Chowan University

A prion protein is a normal cellular protein found primarily in the brain that, when misfolded, becomes infectious and resistant to degradation. The normal, functional form of the protein supports nervous system function, but when it misfolds into the pathological isoform, it can lead to neurodegeneration. When α-helices misfold into β-sheets, the insoluble β-sheets aggregate into amyloid fibrils. These fibrils accumulate in the nervous system and contribute to prion-associated neurodegenerative diseases. To investigate the amyloidogenic regions of the human prion protein and ten other species, we used eight different computational programs (AggreProt, Aggrescan, FoldAmyloid, PAPA, PASTA 2.0, TANGO, WALTZ, and ZipperDB). We compared our computational estimates of amyloidogenic regions of the human prion protein with experimental estimates to determine which computational program best predicts amyloidogenicity. The best-predicted program has been used to evaluate amyloidogenic regions in other prion proteins. Much remains to be discovered about the role prion proteins play in neurodegenerative disease, but using computational programs to predict amyloidogenic regions highlights the protein segments most implicated in cognitive decline.

Microwave Spectrum and Analysis of 2,4,6-Trifluorophenol

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Mentored by: Gordon Brown

South Carolina Governor's School for Science & Mathematics

Microwave spectroscopy is a physical chemistry technique that uses microwave radiation to measure the rotational spectrum of polar molecules. Each spectrum produced is entirely unique and functions like a fingerprint that can be used to identify unknown chemicals and give valuable insights about their specific geometries that determine their functions. The purpose of our research was to measure and analyze the microwave spectrum of 2,4,6-trifluorophenol in order to determine its shape using a custom-built spectrometer. We measured the spectrum using chirped-pulse Fourier transform microwave spectroscopy with a range from 8,000 MHz to 18,000 MHz. From there, we used the Gaussian 03W software suite to predict the spectrum of 2,4,6-trifluorophenol, which we compared to our experimental results to determine the spectroscopic constants. We successfully measured the rotational constants, which can be used to reveal the shape of the chemical. We also measured the distortion constants, which are related to the chemical's flexibility.

Creating an Atlas of Human Variation in Bone Mircoarchitecture During Ontogeny

Kristen Holt

Mentored by: Gwen Schug

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This study aims to create an atlas of compact bone microstructural variation from infancy to adolescence. There are many adult skeletal studies that show how cortical architecture responds to mechanical loading, but subadult microstructure remains less well characterized, despite its important contribution to epidemiological factors involved in osteoporosis and arthritis. Archaeological collections provide ethical access to subadult bones that are otherwise rarely available for high-resolution imaging. This study uses existing Micro CT scans of femoral and humeral midshafts. We will quantify age-related variation in cortical bone geometry, bone volume, porosity, and tissue architecture. We will examine whether specimens with independent evidence of stunting and wasting (low BMI for age) show patterns outside the variation observed in the reference sample. Preliminary results point to adolescent cortical bones being spatially heterogeneous and to pore volume, location, orientation, and connectivity all possibly providing developmental markers of bone deposition, cortical drift, resorption, and remodeling.

Text Message Interruptions and Reading Comprehension in College Students

Nyia Howard

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Previous research suggests that switching attention to text messages can interfere with academic tasks. This study examined whether brief text-message interruptions during reading were associated with differences in college students' reading comprehension and memory. To date, 72 participants read an English-language passage with or without four timed text-message prompts, completed a 10 multiple choice quiz and answered questions about mobile-phone use on a 5-point scale from least likely to most likely online through Qualtrics. Preliminary analysis with an independent-samples t-test showed a significant difference in memory scores between the two groups, $t(70) = 2.52$, $p = .007$ with control group scoring higher ($M = 7.83$, $SD = 1.75$) as compared to the group with text message interruptions ($M = 6.18$, $SD = 2.57$) indicating the damaging effect of interruptions on student comprehension and memory supporting the study hypothesis. Median ratings were 4 for in-class social-media use, mobile-phone use, text messages, frequent phone use, and loss of sleep; 3 for unnecessary phone use; and 2 for spending more money on phone than course materials. These findings add a controlled reading task to research on digital task switching and describe students' reported phone-use habits alongside memory and comprehension measures. By examining comprehension alongside students' reported phone habits, the study contributes to understanding how everyday digital interruptions may relate to academic work. Data collection is ongoing, and final results will be presented at the conference.

The Impact of Switzerland's High-Deductible Insurance Model on Access to Primary Preventative Services

Braelyn Howard

Mentored by: Stephanie Bunch

Wake Forest University

Switzerland's mandatory universal insurance system allows residents to choose annual deductibles, creating different out-of-pocket costs before coverage begins. Although universal coverage supports access, higher deductibles may discourage primary preventive care, delay disease detection, and increase downstream costs. Prior studies link higher deductibles with lower preventive service use, but less is known about healthcare professionals' perceptions. This exploratory study examined healthcare staff perspectives in Interlaken, Switzerland, on how deductible structures may influence preventive care utilization and inform policy discussions. A literature review using PubMed and Google Scholar examined Switzerland's insurance model, deductible structures, and preventive care utilization. Healthcare professionals from fourteen Interlaken practices were contacted for semi-structured interviews, with four interviews completed with professionals from nursing, primary care, walk-in care, and community pharmacy. Interviews explored how deductible structures within Switzerland's universal healthcare system may affect preventive care delivery and utilization. Recordings were transcribed, de-identified, and coded using thematic analysis, with the Consolidated Framework for Implementation Research guiding interview development and theme organization. Findings suggest Switzerland's deductible-based model may influence access to primary preventive healthcare. Literature indicated higher deductibles are associated with fewer routine primary care visits. Participants valued universal coverage for supporting access regardless of socioeconomic status, particularly for emergencies and serious illness. However, high premiums, age-related cost concerns, workforce shortages, and deductible-related financial considerations may affect when patients seek routine care. Participants emphasized primary care providers' role in encouraging prevention. This pilot study highlights the need for universal systems to preserve equitable access while minimizing financial barriers to preventive care.

The Expansion of Life, Businesses, and Infrastructure in Charlotte

Mikaria Hunt

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

The population in Charlotte, NC, is projected to have around 400,000 new residents in the following 15 years. Businesses and city leaders use creativity by collecting community residents' feedback and other resources to expand the city of Charlotte and make it feel more welcoming. Because of this growth, I was curious to learn exactly how businesses and city leaders are innovating development to support current and future residents and visitors. This project matters because it explains the key changes happening in our city and how we can adapt to or update these developments. Furthermore, how have local businesses and the city's infrastructure been creatively productive during this time of expansion in Charlotte? To answer my inquiry question, I researched general, qualitative, quantitative, and mixed-methods sources. To observe creativity in the real world, I will go on an adventure around Uptown Charlotte and take photos and notes about the active projects and construction that are currently in development. This project is still in progress; however, I anticipate that the answer to my inquiry question will likely be that city leaders and business owners plan to collect surveys, resident feedback, and useful resources for ideas and advice to increase the city's infrastructure to hopefully match the vast increase in population. In conclusion, the goal is to create an environment where the community feels seen and heard through small and big gestures to improve the physical aspects throughout the city. It is important that current and future residents enjoy the city they live in because it provides a clear impression of the city's character for incoming residents and visitors.

Impacts of Japanese Knotweed on Nitrate Dynamics and River Continuum Patterns in Appalachian Mountain Streams

Emily Hurst, Robert Fieldsend, Sarah Chambers

Mentored by: Shea Tuberty

Corinth Holders High School

Japanese knotweed (Reynoutria japonica) is an invasive species that dominates riparian zones, which are the areas of land bordering rivers, streams, or lakes. This study examined the plant's influence on nitrate dynamics within Appalachian streams, focusing on Wilson Creek, North Carolina. We hypothesized that the stream sites with R. japonica present would exhibit lower nitrate concentrations than sites without, but that this suppressive effect of R. japonica would weaken as the stream order increased. Using field measurements and stem density counts, we compared nitrate concentrations between knotweed-present and knotweed-absent sites across eight sites over three years. Stream sites with knotweed present had significantly lower mean nitrate concentrations (0.198 mg/L) than knotweed-absent sites (0.355 mg/L; one-tailed $p = 0.0476$). Stem density showed a moderate negative correlation with measured nitrate concentration ($r = -0.55$); however, this trend was not statistically significant ($p = 0.101$), likely due to limited sample size ($n=4$). These results are notable because they contrast from what is expected based on the River Continuum Concept (RCC), which predicts an increase in nitrate, suggesting that the presence of R. japonica may disrupt expected nitrate dynamics in Appalachian streams.

How Differing Theories of the 1985 Enrique Camarena Murder Reshaped U.S.-Mexico Diplomacy

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Mentored by: Jurgen Buchenau

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Against a backdrop of transnational drug trafficking, institutionalized corruption, and covert intelligence operations, this project investigates the1985 abduction and murder of DEA agent Enrique Camarena in Guadalajara Mexico, in order to answer a central historical question: who pulled the trigger? Rather than treating the assasination as an isolated cartel action, this project examines three competing explanatory frameworks: the view of the U.S. administration of President Ronald Reagan emphasizing the incompetence of the Mexican state cartel power, the theory of U.S. Senator Jesse Helms (R-N.C.) highlighting Mexican complicity amongst broader systematic corruption, and the theory of Mexican journalist Manuel Buendía alleging clandestine operations and connections among drug traffickers, Mexico's Federal Security Directorate, and U.S central intelligence agencies. Utilizing a comparative historical methodology, this investigation analyzes diplomatic sources, court records, congressional hearing transcripts, and archival intelligence reports. These findings reveal that Camarena's murder served as the critical inflection point within U.S-Mexico relations that exposed the failure of bilateral counternarcotics cooperation. By contrasting these distinct theories, the project demonstrates how institutional complicity and intelligence networks actively facilitated cartel expansion and hindered justice.

Exploring Honey-Derived Vesicle-Like Nanoparticles as a Delivery System for Hydrophobic Compounds in Zebrafish Embryos

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Mentored by: Jennifer Williams

North Carolina School of Science and Mathematics

Many therapeutic compounds are hydrophobic, which can limit their solubility and absorption in the body, creating a need for effective delivery systems. Synthetic nanoparticle-based delivery systems can improve the transport of hydrophobic compounds, but their production may require complex processes and costly materials. Naturally derived nanoparticles could provide a more accessible delivery approach. This study investigated whether honey-derived vesicle-like nanoparticles (VLNs) could enhance uptake of Nile Red in zebrafish embryos. Honey-derived VLNs were isolated through differential centrifugation and ultracentrifugation and characterized using nanoparticle tracking analysis. ZetaView analysis measured 6.5×10^9 particles/mL with a mean diameter of 143.7 nm in normal VLNs and 8.3×10^9 particles/mL with a mean diameter of 133.6 nm in heat-treated VLNs. Heat treatment resulted in a greater particle concentration and smaller mean particle size, consistent with particle disruption. Preliminary toxicity was evaluated by exposing zebrafish embryos to VLN concentrations and monitoring survival, morphology, and heart rate. Embryos exposed to various concentrations showed 100% survival. Fluorescence uptake experiments compared Nile Red alone, Nile Red combined with normal VLNs, and Nile Red combined with heat-treated VLNs. At 1×10^8 particles/mL, normal and heat-treated VLNs produced higher body fluorescence than the control, with CTCF values of 1.15×10^6 and 9.98×10^5 AU, respectively, compared with 2.18×10^5 AU for the control. These preliminary results suggest that honey-derived VLNs may enhance Nile Red uptake and support investigation as naturally derived carriers for hydrophobic compounds.

ECOSORT: Automated Waste Sorter

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Mentored by: Heather Song

Central Piedmont Community College

Waste contamination remains a major barrier to effective recycling, as incorrectly disposedmaterials compromise entire batches of waste and contribute to landfill overflow, greenhouse gasemissions, and the loss of recoverable resources. This project addresses that challenge byinvestigating whether a low-cost, Arduino-based Automated Waste Sorter can improve accuracyat the point of disposal. Prior studies in waste management and environmental engineeringhighlight the need for scalable, community-level technologies that reduce human sorting errorand strengthen recycling systems, informing the direction of our inquiry. Our methodologyintegrates engineering design, sensor technology, and iterative testing. The prototype uses aninfrared sensor to detect object presence, a raindrop sensor to differentiate wet and dry waste,and inductive proximity sensor to identify metallic materials. Sensor inputs are processedthrough programmed decision-logic that activates a motorized mechanism to direct items intodesignated compartments. Calibration trials using waste samples—including aluminum foil, drypaper, and water droplets—demonstrated that the system can reliably distinguish between wet,dry, and metallic materials. These findings suggest that automated sorting is feasible at a smallscale and can be adapted for larger operations. The project concludes that a modular, low-costsegregation system has the potential to strengthen recycling efficiency, encourage properdisposal habits, and reduce strain on waste management facilities. This research contributes toongoing efforts to develop accessible sustainability technologies that support cleaner, moreresilient communities.

Social Workers' Perceptions of the Benefits, Risk, and Ethical implications of Artificial Intelligence in professional practice

Alivia Ingram

Mentored by: Paige Moore

Meredith College

Artificial Intelligence (AI) is rapidly becoming integrated into social work. Social work is a helping profession focused on improving individuals' well-being and addressing personal, family, and community challenges (NASW, 2021). AI technologies can offer opportunities to improve understanding, assist in understaffed areas, relieve administrative burdens and even support decision making, however, the integration raises significant ethical, professional, and practical concerns. Existing literature emphasizes the potential and even a refusal to "fall behind" supporting the benefits of AI. Despite the growing usage, many are reluctant to make the technological change due to risk of privacy, ethical considerations, and becoming incompetent in empathetic and critical thinking. This study examines how practicing social workers perceive the benefits, risks, and ethical implications of AI in the social work practice. The goal of this study is to better comprehend the growing connection between AI and social work. The findings provide insight into how social workers balance this innovation as well as the professional core values they swore to uphold. Keywords: Artificial intelligence(AI), Social Work, Social Worker, Ethics, Professional value, AI adoption, Human services.

The Correlation Between Unified Parkinson's Disease Rating Scale Score and Power Spectral Density in Parkinson's Disease Using EEG Imaging Data

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The objective of this study was to characterize the correlation between Unified Parkinson's Disease Rating Scale (UPDRS) scores and Power Spectral Density (PSD) in individuals with Parkinson's disease using EEG data. The original dataset includes 139 participants, 94 with Parkinson's disease and 45 controls, who completed various interval timing and cognitive tasks while EEG was recorded using a 64-channel BrainVision cap. Each participant had 160 trials consisting of text displayed on computer screens that read as either "long interval" lasting 7 seconds or "short interval" lasting 3 seconds (Singh et al., 2023). It was a blind study because the researchers never said what the interval durations were. Short interval questions were displayed for 6 seconds. Long interval questions were displayed for 14 seconds. Participants had to press the spacebar when they thought the targeted time had passed (Singh et al., 2023). In this study, 52 participants were selected randomly from the original dataset - 26 PD patients, and 26 Non-PD Patients (Controls). The key result of this study is that the sample size used from the original dataset does not support a clear link between the average Power Spectral Density (PSD) score of the subject and their Unified Parkinson's Disease Rating Scale (UPDRS) score.

The Geographic Lottery & Global Inequality

Opemipo Isijola

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Where a person is born can have a significant impact on the opportunities and outcomes available to them. This project explores the concept of the "geographic lottery," or the idea that circumstances of birth can shape an individual's access to education, healthcare, economic opportunity, and social mobility. The central research question is: To what extent does birthplace influence an individual's life opportunities and outcomes? Using Nigeria as a primary case study, this research examines how colonial legacies, political and economic institutions, resource wealth, and uneven development have contributed to differences in opportunity across regions and communities. The project draws on existing literature in economics, sociology, and global development, including research on institutions, colonialism, and global inequality, to examine the relationship between birthplace and life outcomes. The literature suggests that individual outcomes cannot be understood solely through personal choices or effort, as broader systems and circumstances can create significantly different starting points. Nigeria provides a valuable case for examining these dynamics because its colonial history, resource wealth, institutional development, and regional disparities illustrate how historical and structural conditions can shape access to opportunity. By bringing together perspectives from economics, sociology, and global development, this research examines how individual circumstances are connected to larger historical, institutional, and economic systems, providing a more comprehensive understanding of why birthplace can influence life outcomes. Ultimately, the project invites greater consideration of what "equal opportunity" means in a world where starting points are inherently unequal.

Optimization of a Biofilm Assay to Study Pseudomonas aeruginosa Growth on Medical Materials

Emelyn Jackson

Mentored by: Leila Reyes Ruiz

Campbell University

Optimization of a Biofilm Assay to Study Pseudomonas aeruginosa Growth on Medical Materials Emelyn Lacour and Leila Reyes RuizDepartment of Biological Sciences, Campbell University, North Carolina Bacterial biofilms on medical equipment are a major source of hospital-acquired infections, yet the conditions that allow the bacteria to develop optimally are not fully understood. Pseudomonas aeruginosa is an opportunistic pathogen capable of forming biofilms and is a common cause of hospital-acquired infections. The goal of this project is to determine conditions that promote P. aeruginosa growth on medical equipment. We began with sterile gauze and will later test catheters, needles, and other wound management materials. The first step was to optimize a 24-well plate biofilm assay by comparing pipetting and decanting methods for liquid removal. Plates were inoculated with P. aeruginosa and statically grown in LB broth for 48 hours at 37°C. Biofilms were fixed with methanol, stained with crystal violet, solubilized in ethanol and quantified by measuring absorbance at 600nm. Data shows that removing liquids through pipetting produced cleaner results and decreased well contamination compared with decanting. Furthermore, sterile gauze in the wells retained significant amounts of bacteria. A higher amount of biofilm in the gauze was observed when the liquids were removed from the corner of the well rather than directly from the center of the gauze, suggesting that suction can disrupt the attached biofilm. These results helped us establish an optimized procedure and demonstrated that gauze can support P. aeruginosa growth. This protocol sets the stage for investigating how P.aeruginosa biofilm develops on additional medical materials and devices, with the goal of developing strategies to reduce healthcare-associated infections.

The Influence of Oil-Based Fixatives on Perceptions of Fragrance Longevity

London Jackson

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Fragrance longevity is a key factor in consumers' satisfaction. This study investigated how different oil-based fixatives affect perceptions of fragrance longevity. Participants used a Visual Analog Scale to rate the intensity of fragrances over a period of 7 hours. Each fragrance was formulated with a different oil-based fixative, which included avocado oil, olive oil, and sunflower oil. The same fragrance with an aqueous base served as a control. Perceived scent intensity was measured rather than chemical concentration because fragrance perception reflects complex sensory interactions that are not captured by concentration measurements alone. The Visual Analog Scale is specifically designed to make data analysis methods applicable to scent perceptions. Data analysis found that oil-based fixatives composed primarily of monounsaturated fatty acids increased fragrance intensity at a 7 hour benchmark, a duration relevant to most consumers' fragrance use. However, after 7 hours, insufficient evidence was found to support a difference between a water-based fragrance and a fixative primarily composed of polyunsaturated fatty acids. Further research on fixatives composed of saturated fatty acids is recommended. These findings suggest that fragrance formulators should consider fixatives high in monounsaturated fatty acids when looking to extend a product's scent longevity.

The Creative Greenhouse: Exploring How Cities are the Perfect Conditions for Growing Innovation

Emsley Jackson

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

As Carrie Bradshaw once said, “When I first moved to New York, and I was totally broke, sometimes I would buy Vogue instead of dinner. I felt it fed me more.” Big cities tend to have an alluring glow that attracts creatives of all types, who are invigorated just by being there. The literature indicates that this is a symbiotic relationship, that community is a catalyst for innovation, and that the collective energy of a city’s creatives drives it. This project is important because Charlotte is no different, as one of the largest hubs of innovation in this part of the country. This raises the question of how exactly big-city environments function as multi-dimensional creative ecosystems. To answer my inquiry question, I am reviewing relevant research on creativity, self-expression, and urban activity. To observe creativity in the real world, I will personally observe and take notes on the four wards in Uptown Charlotte, noting expressions of creativity across three categories: visual arts/architecture, self-expression, and innovative business models. This project is still in progress; however, I anticipate that the answer to my inquiry question will be that the density, socialization opportunities, and relative anonymity of cities create the perfect conditions for sustaining a creative ecosystem. In conclusion, the results of this project will be especially useful for understanding why creatives gravitate towards larger cities and the benefits of living in them.

Understanding the Impact of Reproductive Hormones on Sleep and Cognition in Women

Mykayla Jacques

Mentored by: Felica Jefferson

North Carolina A&T State University

Throughout a woman's lifetime, her hormonal profile, as well as the status and quality of sleep and cognition, undergoes continuous fluctuations. Compared to men, women are significantly more likely to experience a decrease in both sleep quality and cognitive function. To better understand the dynamic between reproductive hormones, sleep quality, and cognitive function, we conducted a narrative review of scientific literature on the topic, specifically focusing on Polycystic Ovary Syndrome (PCOS). Existing research supports a bidirectional relationship between these factors, demonstrating that hormones modulate sleep while sleep concurrently modulates hormonal function.

CucurBot: A Novel LLM-based Detection of Cucurbit Diseases Using a Hybrid-Edge Cloud Rover

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Mentored by: Laavanya Rachakonda

University of North Carolina at Wilmington

With a market value of over $10 million in North Carolina, Cucurbita pepo, commonly known as squash, is an economically important crop that is vulnerable to many diseases such as powdery mildew, bacterial wilt, and blossom-end rot. Yet, countless farmers still rely on slow, laborious manual inspection to find diseased plants. CucurBot was built to be a low-cost autonomous rover that detects diseased squash plants in the field and maps their locations for farmers. The rover has a hybrid edge design utilizing an ESP32-S3 camera on a pan-and-tilt mount with a GPS sensor and a web dashboard. As it follows a route, the rover takes photos of each plant from four angles, tags the images with GPS coordinates, and stores them locally. When a connection is available, the images are sent to the Llama-4 LLM through the Groq API, which reports whether a plant is diseased. It then names the likely disease and recommends a treatment, and each diseased plant is pinned on an accessible map. Evaluated on a set of 100 squash images, the model reached 93% accuracy and 100% precision. By automating field inspection, CucurBot lowers labor cost and offers an affordable tool that could be extended to related cucurbits.

Building Biorenewable Conjugated Polymers for Solar Panels from Lignin Waste Products

Helin Jaqcueline Herrera Urbina Grant

Mentored by: Jeromy Rech

University of North Carolina at Asheville

Strategies in renewable energy which leverage both new technology and sustainable materials are most likely to have the strongest impact. We are especially interested in organic solar cells, a complementary technology to traditional solar panels, which use conjugated polymers to generate electricity upon irradiation from sunlight. These conjugated polymers are conventionally synthesized from petroleum derived starting materials, raising concerns about the long-term environmental impact and resource depletion of fossil fuels. To address this concern, we are specifically attempting to use lignin, an abundant waste biopolymer found in plant cell walls, as the starting feedstock for aromatic monomers used to create conjugate polymers. Lignin naturally contains many aromatic rings which share some similarity to those found in some conjugated backbone polymers. The MEH-PPV polymer, one of the first conjugated polymers used in organic solar cells, in particular shares many attributes to lignin components, making it a candidate for sustainable green design. This work aims to establish a synthetic framework to transform waste biomass into high value conjugated materials. Creating new viable lignin-based pathways to conjugated polymers could reduce the reliance on fossil fuel feedstocks and contribute to sustainable materials for organic solar cell applications.

Distributed Ionogel Proprioception in a Kirigami Pneumatic Actuator

Rishi Jasti

Mentored by: Hanbin Choi

North Carolina School of Science and Mathematics

Soft robots have been proven to be a viable mechanism for interaction with humans and delicate objects, however their main constraint, continuous deformation, makes soft robots difficult to control precisely because they cannot measure their own shape in real time. Modern solutions either embed rigid sensors that compromise the structural a priori for using soft robots or rely on external tracking that is extremely difficult to reproduce outside lab settings. This project characterizes a 2-HEA/EMIM DMP ionogel as a distributed proprioceptive strain sensor in a soft kirigami pneumatic actuator, designed with PDMS panels rotating axially and radially to ionogel hinges, making the actuator the mechanical vehicle that places the ionogel under realistic cyclic strain. Mechanical testing across ionic-liquid molar ratios of 0.28, 0.45, and 0.60 established the ionogel's tunable modulus from roughly 40 to 110 kPa, while peel testing confirmed that plasma treatment produces interfaces with cast PDMS stronger than the ionogel bulk itself. Capacitive sensing tests under cyclic 16 percent strain yielded a steady-state gauge factor near 0.83, with the response stabilizing after a break-in period of roughly fifteen cycles. The measured gauge factor and noise floor set each candidate hinge's sensitivity to actuator shape, a Fisher information matrix combines these sensitivities to measure the shape information any sensor subset carries, and D-optimality selects the subset minimizing the Cramer-Rao lower bound on reconstruction error. Together, this device-level ionogel characterization and the placement framework turn the ionogel from a candidate material into a quantified distributed sensor, advancing soft-robot proprioception.

The Outsider's Dilemma: Epistemic Responsibility and Competing Interpretations of Religious Experience

Rishi Jasti

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This project examines the interpretability of the religious experiences of others when lacking direct access to the experience itself but possessing competing rational explanatory frameworks. Although work in philosophy of religion has explored the evidential significance of religious experience and Bayesian and formal epistemology have made significant headway in modeling rational belief, hermeneutic and historical approaches however, have emphasized the difficulty in treating interpretations of religion as rational categorizations due to being shaped by intellectual and cultural contexts. Taken together, this project analyzes possible responses to religious experience, and asks under which conditions such responses are epistemically justified, and if such an epistemically responsible judgement other than withholding judgement is possible. The methodology combines philosophical analysis, examining Bayesian constructions on interpretation and religion, and limited case-study application to contemporary religious conversion. The project argues that neither acceptance nor dismissal of religious experience is automatically warranted, however that attempts at responsible interpretation requires accounting for testimony, multiple explanatory possibilities, the limits of outsider, the historical assumptions shaping what counts as evidence, and contributes a more reflexive, historically informed, and philosophically rigorous framework for interpreting religious experience.

From Interactome to Intervention: Systems-Level Therapeutic Pipeline with ML-Driven Hub Gene Prioritization and Polypharmacological Drug Discovery in Ischemic Stroke

Rishidharan Jayakumar

Mentored by: Chandrabose Selvaraj

North Carolina School of Science and Mathematics

Stroke remains a major global health burden and a leading cause of death and disability, with ~94 million people living with stroke-related conditions worldwide in 2021. Although current treatments can restore blood flow or reduce clot formation, they work only within narrow time windows and don't fully address the secondary injury processes that continue damaging brain tissue. These persisting effects reflect interacting pathways, including metal-dependent and non-metal-dependent mechanisms that drive inflammation, blood-brain barrier disruption, and cell death. The research goal was to build a systems-biology and computational pipeline to identify post-stroke therapeutic targets and candidate compounds. Stroke patient gene expression datasets from the Gene Expression Omnibus (GEO) were analyzed alongside a stroke-specific protein-protein interaction (PPI) network to capture both gene-level changes and coordinated protein behavior. 11 cytoHubba algorithms were applied to identify hub proteins, and a novel XGBoost-based ML ranking model was developed to prioritize the cytoHubba methods and targets, an approach not previous used for algorithm-guided hub selection. Gene ontology/pathway enrichment and literature review refined the shortlist to four final protein targets with both metal-dependent and non-metal-dependent mechanisms. A marine natural product library was then screened using structure-based virtual screening and molecular docking. Lead compounds showed favorable predicted binding affinities across multiple targets and beneficial pharmacokinetic properties along with "druggability". Molecular dynamics simulations further supported structural stability of the target over time. Future work will focus on in vivo validation and generalizing this pipeline to other neurological disorders driven by complex, interacting protein networks.

Small World Initiative: Evaluating the Antibiotic Activity of Pseudomonas Aeruginosa Against Staphylococcus Species

Kaylyn Jennings

Mentored by: Gregory Johnson

Wake Technical Community College

The overall aim of this project is to test soil bacteria and their secondary metabolites against resistant pathogens to find new antibiotics. Antibiotics are constantly used among medical professionals to help the body fight infections, but this constant use has led to pathogens gaining resistance to antibiotics that can no longer be relied on. The soil is a rich environment of microbes including bacteria that produce their own antibiotics called secondary metabolites to compete for resources. By extracting the secondary metabolites made by soil bacteria and using them in a modified Kirby-Bauer test, a strain of Pseudomonas aeruginosa has demonstrated profound antibiotic activity against Staphylococcus epidermidis. To explore this activity further, we've tested the metabolites against other species of Staphylococcus using Kirby-Bauer disks to make the conditions slightly more controlled than before. We found that Staphylococcus saprophyticus and Staphylococcus simulans showed similar susceptibility to the Pseudomonas metabolites. These results have given us more insight into a potentially new antibiotic to treat staph infections that may not respond to other antibiotics. Further research is currently being done to determine the identity of the metabolite(s) causing previously seen results.

Seniority and Stability: Examining Legislative Agenda Patterns in Congress

Ava Jessup

Mentored by: Eric Heberlig

University of North Carolina at Charlotte

This study examines the relationship between seniority and stability in Congress members' legislative agendas. This study uses a dataset containing various variables related to members of Congress, with a specific focus on bill introduction patterns. By examining these patterns, the research analyzes whether legislators' policy priorities become more or less stable as they gain seniority. By tracking changes in the types of legislation introduced throughout a member's congressional career, the study aims to identify patterns of consistency or instability in their legislative agendas. It considers whether senior members maintain more stable legislative agendas due to experience and established policy interests, or whether their agendas continue shifting over time. Additionally, the research examines how changes in the national political environment may contribute to fluctuations in legislators' policy priorities, regardless of their level of seniority. Understanding these relationships may provide insight into whether legislative experience encourages greater policy specialization or whether external political circumstances continue to influence agenda development. By analyzing these factors together, this research seeks to better understand how seniority shapes the stability and evolution of legislative agendas over the course of a congressional career.

The Role of the Gut Microbiome and Nutrition in Preeclampsia

Grayce Jeter

Mentored by: Alicia Dahl

University of North Carolina at Charlotte

Global fertility and birth rates are declining at an unprecedented rate. Primary factors contributing to this declining health crisis are lower mean age at childbearing (MAC), an increased diagnosis rate of fertility related conditions, and the lack of sexual and reproductive health education. In addition, maternal mortality is another global health crisis. It is estimated that a woman dies due to pregnancy related complications every two minutes with preeclampsia being the number one cause of maternal mortality, occurring in 2-8% of pregnancies. The goal of this literature review is to explore the use of nutrition and pharmaceuticals to improve the gut microbiome of preeclamptic mothers in hopes of treating and even preventing the gastrointestinal inflammatory response associated with a preeclampsia diagnosis. Synthesized findings reveal that there is a connection between preeclampsia and inflammation in the gut microbiome which can be treated with nutrition in conjunction with pharmaceuticals for other symptoms associated with preeclampsia. Addressing the health of pregnant and perinatal women by exploring multiple pathways to improving the overall health of a woman may in turn combat the declining birth and fertility rates while also addressing maternal mortality.

Independent in Name Only: Media Labor and Corporate Power in WWE

Nia Jeter

Mentored by: W. Russell Robinson

Winston-Salem State University

WWE's independent-contractor model shapes relationships between corporate control, media production, and labor. This can be seen in former Women's Champion Trish Stratus' recounting of being stripped of her title after refusing to kiss another female wrestler. She describes saying "No" to the creative decision and being booked to lose her title immediately afterward as a "punishment for her decision." Stratus' experience demonstrates how WWE's control over its media product can also function as a form of labor control, as a wrestler's employment conditions and public performances remain closely tied to the company's creative decisions. My central research question asks: How does WWE's classification of wrestlers as independent contractors complicate the meaning of "independent" work when performers remain subject to organizational and creative control? Using Marxist Political Economy of Media as a theoretical lens, my presentation examines commodification, labor, ownership, profit, and cultural narratives of entrepreneurship. Through a case study approach, this project explores WWE's corporate labor structure, focusing on the commodification of the millennial body and the marketing of the American work ethos within a global economic ecosystem. Ultimately, my project demonstrates how wrestlers' bodies, identities, emotional engagement, and creative performances become commodities within WWE's profit-driven media system.

A Comparison of the Effects of Mindfulness Meditation, Coloring, or Both on State Anxiety Among College Students

Aprayer Johnson

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

College students often experience anxiety related to academic demands and personal responsibilities. This ongoing study examines whether changes in state anxiety differ among students assigned to mindfulness meditation, mindfulness coloring, or a combination of both activities. Participants are randomly assigned to one of the three conditions and complete the State-Trait Anxiety Inventory before and after their assigned activity. Although the Perceived Stress Scale is also collected, this presentation focuses on state anxiety. In the preliminary sample of 67 participants, change scores were calculated by subtracting posttest scores from pretest scores, so positive values indicated reduced anxiety. A one-way analysis of variance found that differences in mean change across conditions were not statistically significant, $F(2, 64) = 2.557$, $p = .085$, eta squared = .074. An exploratory Fisher's LSD comparison found a difference between the combined-activity group (mean change = 1.53) and the meditation-only group (mean change = -0.70), $p = .028$. This pairwise finding should be interpreted cautiously because the overall test was not significant. Data collection will continue through the November presentation, when the analyses will be updated. The study may help clarify how different brief relaxation activities relate to changes in college students' state anxiety.

Effect of Macrophage Polarization on Lipid Uptake and Foam Cell Formation

Brittany Johnson, Amira Brown

Mentored by: Shan Nagarajan

High Point University

Atherosclerosis is a chronic inflammatory cardiovascular disease characterized by lipid deposition and plaque formation within the arterial wall (Wu et al., 2023). During lesion development, macrophages internalize modified low-density lipoproteins, including oxidized LDL, through scavenger receptors, leading to intracellular lipid accumulation and foam cell formation (Zhang et al., 2023). Because macrophages can easily change their physical traits, IFN-γ/LPS stimulation promotes an M1-like inflammatory phenotype, whereas IL-4 promotes an M2a-like phenotype (Eshghjoo et al., 2022). This study investigated how M0, M1-like, and M2a-like RAW-Dual macrophages differ in lipid accumulation after exposure to modified LDL. Phenotypic activation was evaluated using the Quanti-BLUE assay of SEAP activity as a readout of NF-κB/AP-1 signaling and Quanti-Luc measurement of luciferase activity as a reporter of interferon-regulatory factor–dependent signaling. Oil Red O/Nile Red staining with DAPI nuclear counterstaining was used to quantify intracellular lipid accumulation. M1 and M2 polarization increased Nos2 and Arg1 mRNA expression, respectively, confirming expected polarization-associated gene expression patterns. SEAP and Lucia luciferase reporter activity further confirmed macrophage polarization. After modified LDL exposure, M1-like foam cells showed the greatest lipid accumulation among the experimental groups, suggesting that inflammatory activation enhanced modified LDL uptake under these conditions. The findings support that the M1-polarized foam cells exhibited the highest lipid uptake when compared to other experimental groups. This suggests that macrophage phenotype influences lipid-handling pathways involved in lipid uptake, storage, inflammatory signaling, and cholesterol efflux. Overall, the findings demonstrate a clear relationship between macrophage polarization and lipid uptake, that may contribute to atherosclerotic plaque progression.

An Assessment of Workplace Policies and Support on Breastfeeding Among Employed Mothers

Chandler Johnson

Mentored by: Jessica Escobar DeMarco

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Breastfeeding provides important health benefits for mothers and infants, but returning to work can make it difficult for mothers to continue breastfeeding. Workplace barriers can include limited break time, lack of private space, and limited workplace support. This project examines publicly identified breastfeeding support among large employers in North Carolina and asks how this support differs across employment sectors. The study will review 20 large employers with at least 1,000 employees across four sectors: healthcare, retail and service, corporate and finance, and transportation and labor intensive industries. Publicly available company websites, human resources and benefits pages, employee resources, and other company documents will be reviewed. Each employer will be assessed in four areas: break time, private space, timeframe of support, and compensation. Support will be scored from 0 to 2 based on whether it is not publicly identified, meets federal minimum requirements, or goes beyond the federal minimum and aligns with enhanced workplace breastfeeding recommendations. Results will be compared across the four sectors to identify common areas of support and potential gaps. This research may help show how workplace policies differ across industries and identify areas where stronger workplace support could benefit employed mothers and their families.

Historical and Intergenerational Trauma in Healthcare Experiences of South Asian Migrants

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Every individual carries an entire story with them, even when that story is not immediately visible to anyone else. Healthcare systems increasingly recognize social determinants such as income, housing, education, transportation, and language, but the historical experiences, memories, and traumas that shape how individuals understand themselves and interact with institutions can be much harder to see. This project explores how historical and intergenerational trauma may influence the healthcare experiences of South Asian migrants and how healthcare professionals can become more aware of these experiences without making assumptions about any individual patient. This research was conducted through a Health and Medical Humanities seminar course, using Google Scholar to identify and examine existing literature (n=7) on South Asian migrant healthcare experiences, trust, cultural barriers, historical trauma, and patient-centered care. Research was used alongside the development of two personas representing a South Asian migrant patient and a physician to better understand the perspectives, barriers, and needs of both groups. The findings informed the development of a proposed digital campaign primarily directed towards physicians. Grounded in the Transtheoretical Model, the campaign aims to encourage physicians to move from simply recognizing these issues toward intentional changes in how they communicate with and listen to patients. This project emphasizes that recognizing a patient's history does not mean assuming what they have experienced. Rather, it means creating a healthcare environment where patients feel safe enough to share what matters to them, allowing their dignity, autonomy, and individuality to remain central to their care.

Which is better: Expert curated knowledge base or general purpose LLM

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Large Language Models (LLMs) have demonstrated strong performance across a wide range of domains, however their tendency to hallucinate information remains a significant limitation in specialized scientific fields. This research investigates whether a domain-specific chatbot can reduce hallucination while improving the relevancy and accuracy of expert-level information in the quantum chromodynamics field. The proposed system uses Retrieval-Augmented-Generation (RAG) with a curated knowledge based development in collaboration with field experts. The chatbot is implemented using LightRAG paired with GPT-4o mini for information retrieval and output generations, and MinerU for intelligent document parsing. LightRAG processes uploaded documents and constructs relationships among shared entities i.e. technical physical concepts and terminology. To evaluate the system, members of the research group will provide a set of relevant questions. These questions will be submitted to both the specialized chatbot and a state-of-the-art general purpose LLM such as ChatGPT. Performance of the specialized chatbot will be assessed using evaluation frameworks such as RAGAS and TruLens, supplemented by expert evaluation from industry specialists. This study aims to compare the relative strengths of the two systems across multiple query types, including general, targeted, quantitative, qualitative, information-retrieval, and educational queries. These results will aid in determining when specialized RAG-based systems provide advantages over general purpose LLMs for specialized field knowledge.

Quantum-Accelerated Steiner-Tree Optimization for Real-Time Disaster Relief Operations

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Quantum computing is an emerging field in Physics, allowing us to perform algorithms that would be impossible on a classical computer. This ability to solve problems uniquely has been used to solve Steiner tree problems, or problems that ask for the shortest path between given vertices in a tree. Thus far Steiner tree problems have only been solved by quantum algorithms in theoretical cases. Therefore, we implemented quantum algorithms to solve the real-world logistical problem of where to place radio repeaters to restore communications following a disaster scenario. We wrote a program that would convert a graph into a procedurally generated quantum circuit. We then ran Grover's algorithm on the circuit in order to find solutions. The result of this study was a program that was able to consistently generate solutions to a given tree. The tested trees were typically 7-12 nodes. The program was able to consistently generate solutions more than non-solutions, with tests on subgraphs giving occurrences of solutions within the ten most selected outputs. The results of this study imply that the methodology we used to procedurally generate this algorithm could be improved in order to apply to larger trees.

Predicting Extremism: Social Media News Consumption and Authoritarian Personality Theory

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In 2024, over 50% of U.S. adults reported they were likely to consume news via social media. Public debate increasingly links social media use to political polarization. I explore if social media news consumption is independently correlated with ideological extremity, or if it co-occurs with authoritarian personality traits. Using the 2024 American National Election Studies dataset (N=4896), preliminary bivariate estimations reveal an exposure threshold: ideological extremity differs significantly at 3+ days of weekly social media use. To fill this knowledge gap, the present study investigates whether social media news consumption along with authoritarian personality traits are independently associated with extremism, and whether social media news exposure aligns with extremism differently depending on an individual's level of authoritarianism. I use a 3-stage hierarchical OLS regression to (1) control for demographics, (2) test associations between social media news consumption and ANES Child-Rearing authoritarianism, and (3) evaluate interaction effects. I aim to clarify how media exposure maps onto psychological predispositions, and to evaluate if media habits correlate directly with extremity, or if they align with preexisting traits. Examining media exposure alongside psychological predispositions provides a more nuanced understanding of how social media news consumption relates to ideological extremity in U.S. elections.

Brocard Angle Invariance Under Equal Side Division

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Mentored by: Reed Hubbard

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This problem was posed in the American Mathematical Monthly, problem 1202. By taking three points on the on a triangle with equal ratios of the side lengths, we can construct a new triangle whose Brocard angle will be the same. The Brocard angle is the unique angle (\omega) for which drawing it from each corner of the triangle will all converge to the same point. Although the Brocard angle has been studied for over a century, relatively few transformations are known to preserve it. In this project, we investigated the original and inner triangle to prove that their Brocard angles are always the same, regardless of the shape of the original triangle or the chosen ratio for the inner triangle. Using coordinate geometry, side-length calculations, and Heron's Formula, we proved that the two Brocard angles are always equal. By showing showing that the area and the sum of the squared side lengths of the new triangle scale by the same factor. Since tan w = 4A/a^2 + b^2 + c^2 the scaling factors cancel, leaving (\omega) unchanged. This result reveals an unexpected connection between two seemingly different triangles and shows how classical geometry can still contain elegant structures waiting to be discovered.

Signaling Through Consumption: Understanding Brand and Product Attributions Among Gen Z Consumers

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In the market, luxury brands hold status for their products and service quality, prestige, and image. However, changes in media consumption in recent years have caused younger consumers to gain different marketing exposure than in the past decade. While this impacts all brands' positioning strategies, it is unknown what product attributes younger consumers (namely consumers in the Gen Z demographic) attend to when choosing to signal information about themselves to others. A structured interview is planned to identify the major themes present in Gen Z consumers' attitudes regarding what attributes of brands and products they use as signals, as well as what attributes of others' consumption they interpret as signals. The findings of the interviews will inform an experiment aiming to understand the causal association between these product and brand attributes and marketing-relevant outcomes (e.g., willingness to pay or brand equity). The managerial implications of this study would allow brands to utilize the causal relationship to understand consumer-based brand equity. The findings will provide marketers with insights into Gen Z consumers' conspicuous consumption, helping brands refine product positions and marketing strategies for consumers who are encountering more luxury and prestige brands within the mass media.

Evaluating the Physical and Nutritional Properties of Various Extruded Starch Snacks During In Vitro Oral Digestion

Mehr Kapoor

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Nutrient digestibility depends not only on the amount of starch in a food but also on its physical structure. Extrusion is a processing technique where mixed ingredients are forced through a small opening; extruding starches can increase carbohydrate accessibility, while oral digestion is strongly influenced by saliva volume and chewing efficiency. Although previous studies have examined these factors, there is little research on how extrusion level, saliva volume, and mastication (particle size) interact to influence oral digestion. This project will investigate whether extrusion can compensate for reduced salivary flow and mastication to improve nutrient bioaccessibility in starch-based foods during the oral digestion process. Extruded products will be generated with three processing conditions and will be subjected to simulated oral digestion. Carbohydrate breakdown will be quantified using spectrophotometric assays to measure sugar release. Based on previous research, it is expected that higher extrusion processing will alter starch structure and increase nutrient accessibility. If successful, this study is expected to demonstrate that food processing can help maintain nutrient benefits and accessibility even under impaired oral conditions. The findings of this study could inform development of starch-based foods that remain nutritionally accessible for individuals with reduced oral function, such as older adults, while also supporting the use of sustainable ingredients such as grape pomace.

Relating dragonfly family diversity to habitat quality

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Urbanization can alter stream ecosystems by impacting water quality, stream flow, habitat structure, land cover, and riparian buffers. These factors decrease habitat quality. Urban streams erode, lose microhabitats, and therefore lose vital biota. Dragonflies have diverse niches and a variety of tolerance values. Dragonfly nymphs spend much of their early life in freshwater, meaning that they can respond to these environmental changes and are useful for examining stream conditions. Additionally, dragonflies are a terrestrial-aquatic connection that allows for the surrounding habitat to be considered as well. More urbanized streams may support different dragonfly communities than streams with less urbanization.The goal of this study is to evaluate the relationship between dragonfly family diversity and habitat quality. Dragonfly nymphs were collected from each stream using dipnetting and kicknetting. We identified samples to the family level using a standardized dichotomous key. Habitat quality was evaluated using an altered form of the rapid stream quality assessment method.By comparing family diversity across multiple streams, this research aims to determine whether differences in dragonfly diversity are associated with differences in habitat quality. The results have potential to understand dragonfly habitat preference better in urban areas. Understanding how aquatic insect communities respond to urbanization can provide useful information about stream health and support future conservation and management efforts in Mecklenburg County.

A Statistical Assessment of Hydropower's Role in Sustainable AI Data Centers

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Largely powered by fossil fuels, artificial intelligence (AI) data centers are expanding worldwide, fueling AI tools used by over a billion people. This growing demand increases electricity consumption and environmental damage. This study explores how hydroelectric dams can serve as an alternative to fuels such as natural gas for powering AI data centers, thereby reducing AI's carbon footprint. By bootstrapping the power output of 45 rivers and using one-sided 95% confidence interval models in R, we found that hydroelectric dams powered by rivers with an exceptionally high flow rate can fully power an AI data center; however, hydroelectric dams powered by the average river in the US are only able to power 13% to 26% of an AI data center. A visualization was created to compare the dataset with and without outliers, while another was used to display the bootstrap resampling. Our findings highlight the limitations of hydroelectric dams in increasing AI data center efficiency and underscore the need for complementary renewable energy sources.

Design and Development of a Multi-Channel Ion Probe Sensing System for RDE Wave Characterization

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Rotating detonation engines (RDEs) sustain a detonation wave around an annular combustion chamber, offering higher thermodynamic efficiency than conventional deflagration-based engines. Prior studies show ion probes, which detect the conductive plasma behind a detonation front, offer an inexpensive, heat-tolerant way to track wave behavior. Probe circuits must be tailored to each combustor, and the BEFAST Lab lacked a validated multi-channel system for its RDE. This project asks how to redesign ion probe hardware to simplify wiring, enable high-speed readout, and reliably capture quantitative detonation wave data. We designed an 8-channel ion probe printed circuit board routing each channel to a high-speed data acquisition port. A two-probe prototype detected detonation near 17 kHz (about 1900 m/s) and deflagration near 9 kHz. Integration revealed a ground loop, which we resolved in a V2 board by combining probe and instrument grounds and referencing each probe measurement to the shared ground. We then installed four probes in tapped ports on the engine's outer plenum. In a full engine test, all four channels captured a 0.58 second run with a dominant frequency of 15.2 kHz, about 1700 m/s. These results show that the V2 system delivers reliable multi-channel detonation data and simplifies setup for the lab. Ongoing work develops a V3 board with a fast comparator per channel and a microcontroller to timestamp probe arrival times, enabling direct measurement of wave speed, wave count, and rotation direction to guide RDE design.

K-pop Fandom: Associations with mental health, body image, and identity.

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The international spread of South Korean media such as Korean dramas (K-dramas), cuisine, fashion and Korean pop music (K-pop) is known as Hallyu (한류), or the Korean Wave. K-pop in particular has been a part of a wide global spread through the utilization of social media by K-pop fans, creating a thriving and growing community online. Previous literature suggests a possible relationship between K-pop fandom participation and negative body image as well as positive correlations with mental health. Much of the existing literature comes from South Korea as well as surrounding countries. The goal of this study was to evaluate possible relationships between K-pop fandom, mental health, body image, and identity. Participants completed an online survey distributed via social media or Prolific for compensation. Results include statistically significant relationships between K-pop fanship and various aspects of identity including fandom identification, belonging, distinctiveness, and conscientiousness. This study supports optimal distinctiveness theory in relation to K-pop fanship and implies a high amount of identity salience among K-pop fans.

Exploring Demodex Mites (Class: Arachnida) on Captive Lemurs (Family: Lemuridae)

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Mites (Class Arachnida) are arthropod ectoparasites living on hosts. Demodex, a mite genus found on humans, is normally benign, typically only causing dermatological issues when the host is immunocompromised. Mites have been extensively investigated in mammals such as humans and dogs, yet few studies have examined mites on lemurs. Therefore, to systematically study mite presence on lemurs, the Duke Lemur Center (DLC) provided lemur hair samples on slides taken from six facial and eight limb regions during routine veterinary procedures. The hair samples were examined under compound light microscopes using 10x and 40x objective lenses. Unknown objects were photographed and later reexamined in order to determine whether they were mites based on morphology. Hair slides were examined from a total of fifty-nine lemurs belonging to ten species, with mites being found on nine of the lemur species. Thirty-seven potential mites were found, with most of the mites looking like they belong to Demodex. At least one mite could potentially be a new species. This study marks the first systematic sampling of Demodex mites performed across lemur species. In the future, genetic analyses should be conducted to identify the specific mite species found. Studying the presence of mites on lemurs will provide insight into the largely unstudied relationship between ectoparasites and lemurs, and if / how ectoparasite frequency in lemurs can be indicative of population health.

Opioid Use Disorder Strategy Implementation Among North Carolina EMS Systems: A Quality Improvement Framework Analysis

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Between 2020 and 2024, 19,060 North Carolinians died from drug overdose, 76% of which were caused by illicit opioids. Recently, a quality improvement (QI) framework for opioid use disorder (OUD) services was developed, outlining a comprehensive, appropriate set of emergency medical services (EMS) strategies. Our objective was to describe the utilization of OUD strategies among North Carolina (NC) EMS systems. This study surveyed NC EMS systems between February-August, 2026. The survey targeted system demographic, OUD strategy use, and OUD beliefs. Utilizing the framework, 11 treatment, 16 harm reduction, and 11 prevention strategies were determined applicable to NC EMS agencies. More than half (58%, n=58) of NC EMS systems completed the survey. Respondents were predominantly located in rural (71%, n=41) and Piedmont (41%; n=24) counties. Absolute strategy utilization scores were highest for harm reduction (mean=7.25, SD=4.73) compared to treatment (mean=5.28, SD=4.28) and prevention (mean=5.53, SD=3.27). Proportional scores followed similar trends. Most used strategies included: treatment - QI review of all opioid overdoses (67%, n=39); harm reduction - distribution of naloxone kits (76%, n=44); and prevention - integration of EMS and hospital patient records (67%, n=39). Least used strategies were: treatment - gap coverage (31%, n=18); harm reduction - transportation to safer consumption sites (0%, n=0); and prevention - track morphine milligram equivalents (14%, n=8). Of note, staffing issues were the top barrier to implementation across all strategy types. These findings may inform prioritization of prehospital OUD strategies across diverse system contexts. Further research should explore determinants of prehospital OUD strategy selection.

Why are those leaves so red!?! Investigating Leaf Anthocyanin Synthesis Using Remote Sensing and Geospatial Analysis

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In North Carolina, roughly 3.2 million travelers visit areas across the state to see changing leaf colors , generating roughly one billion dollars in revenue(“Homepage | NC Commerce|2024 ”). However, the biological reasons (ex: nutrient deficiency, solar protection, etc.) that lead to the red leaf colors (anthocyanins) are poorly understood. Previous research has not focused on large-area measures, instead focusing on small-scale studies and the physiology behind the change in anthocyanin levels. With this research, the ultimate aim is to address this gap by measuring anthocyanin levels using the Sentinel-2 satellite system across a forested landscape in North Carolina and linking those measurements to landscape-scale properties like erosion. The main project methodology requires monitoring deciduous trees during fall at the Redlair property in Gaston County, North Carolina. The team selected a specific area of the Redlair property and is collecting leaves from trees within areas that match the Sentinel-2 data locations, testing anthocyanin levels at different dates across autumn. These anthocyanin levels will be validated against two spectral indices: the Anthocyanin Reflectance Index (ARI), a vegetation index that uses variables related to plant stress and leaf development to estimate anthocyanin values. Modified Anthocyanin Reflectance Index (mARI) is a vegetation index using remote sensing to estimate anthocyanin values. The indices described above represent anthocyanin levels across multiple wavelengths against the data points collected. Overall, the project is aimed at reducing the data shortfall in terms of anthocyanin concentration to better understand the biological processes that shape a billion-dollar industry in NC.

THE TUUNGANE PROJECT

Irene Kessy

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In recent years, there has been an increase in the number of immigrants in the United States, including African immigrants who may experience challenges adjusting to a new environment, especially caregivers raising children with disabilities. The Tuungane Project will explore and address the experiences and needs of African immigrant and refugee caregivers parenting children with disabilities while navigating the U.S. education and special education system. Existing literature identifies disability-related stigma, social exclusion, caregiver blame, culturally or spiritually influenced understandings of disability, and language barriers that may affect immigrant caregivers when seeking support. This study asks: What are African caregivers' experiences and needs related to parenting a child with a disability? What barriers do caregivers perceive when parenting a child with a disability? How do multilingual support groups influence perceived social support, emotional well-being, and connection to the community? Up to 10 African immigrant or refugee caregivers of children ages 3-16 with disabilities will participate. Participants will complete an initial interview and pre-group questionnaire, four multilingual psycho-educational support group sessions, short surveys after each session, a post-group questionnaire, and a final focus group. Expected findings may identify information gaps, challenges navigating special education, topics for support, and how support groups provide opportunities for caregivers to learn from one another and strengthen social support and community connection.

A Self-Optimizing AI Agent for Rapid Assay Method Transfer to a Closed Platform Liquid Handling Robot

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Mentored by: Marnon Gracieux

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Laboratory automation can improve throughput and reduce manual labor, but transferring and validating bench assays on robotic platforms often requires weeks of expert tuning. Recent AI protocol-generation efforts have focused primarily on open, programmable systems, leaving closed platforms largely unaddressed. This study evaluated whether a large language model (LLM) could generate an executable OneLab (.onp) protocol for the Waters Andrew+ liquid-handling robot that met bioanalytical performance criteria. Using an established direct fluorescence assay for green fluorescent protein (GFP), the LLM received the laboratory SOP, vendor-published OneLab protocols, and defined physical constraints. Performance was compared across three approaches: manual hand pipetting, robot protocols developed by human analysts, and an AI-generated robot protocol. All approaches were evaluated against a same-day manual baseline using accuracy (%RE <=15%), precision (%CV <=15%), linearity (R2 >=0.99), and curve slope agreement. Human-developed robotic protocols required weeks of optimization and underperformed the manual assay. In contrast, the AI generated a passing protocol in minutes, achieving R2 values of 0.998-0.9998, mean %RE of 0.8-2.9%, %CV of 0.7-1.0%, and slope agreement within 1-2% of the manual baseline. Three independently generated AI protocols were nearly identical (600 of 602 fields), and their executed results agreed within approximately 1.6% CV. These findings suggest that LLMs can rapidly generate validated, reproducible protocols for closed robotic platforms, potentially reducing the expertise and time required for assay method transfer.

Evaluation of Tick Ecology in Mecklenburg County Parks and Recreation Centers

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Ticks are the leading cause of vector-borne disease transmission in the United States. Following bites, ticks can transmit multiple pathogens, which can be severe if untreated. Shifting tick abundance and pathogen exposure are growing public health concerns. Previous surveillance in North Carolina has largely focused on individual species or limited sites, leaving Mecklenburg County (MC) underrepresented. This study aimed to estimate prevalence and density of ticks in MC during the high-risk season. We conducted a cross-sectional study across parks and greenways (n=30), from June through August 2026, selected by ecology, visitor activity, and previous data from the Zoonotic and Vector-Borne Diseases Laboratory. Ticks collected by flagging along at least eight 100-m transects at each site were identified morphologically under a stereomicroscope. A site was defined as positive if at least one tick was collected, and density was calculated as ticks per 1,000 m sq sampled. A total of 18 sites (60%) were positive, with an overall density of 7.52 ticks/1,000 m sq. Four tick species were identified: Amblyomma maculatum (58.5%), followed by Haemaphysalis longicornis (36.7%), Dermacentor variabilis (3.4%), and Amblyomma americanum (1.4%). Tick density was greater in southern MC. To our knowledge, this is the first comprehensive study on the occurrence of ticks in MC. These findings suggest that historical estimates have underestimated local tick abundance, highlighting the need for expanded risk communication for the public and physicians. Future studies should test local ticks for pathogens and explore environmental drivers of tick distribution.

The Price of a Name: An Analysis of the Increasing Medicalization of Sadness

Arnav Khanna

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

The Price of a Name: An Analysis of the Increasing Medicalization of SadnessBy: Arnav KhannaBased on the shifting of the line between depression and suffering over time, has the introduction of new medical classifications helped people or ostracized normal people going through difficult times? Through analysis of changing medical regulations in the official DSM, and a meta-analysis of studies conducted by psychologists who specialize in neurological disorders and depression, the broadening of what can be classified as depression has only had an impact on society for the worse. The line between grief and depression is thinning down, giving people a chance to make depression a scapegoat for their normal human response to trauma. The timeline of the change in diagnosis criteria for depression too conveniently aligns with the timeline of pharmaceutical companies manufacturing of antidepressants. The drug came before the disease, and the advertising came afterward to sell the disease in order to sell the drug. In short, an analysis of the change in what could be classified as depression over time suggests that depression is unfortunately becoming a forceful crutch for those going through normal traumatic events, and pharmaceutical companies are doing their best to foster an environment to maintain those conditions. The argument here is not that depression isn’t real, but that its increased accessibility is negative for society. This is a severe issue because around 3-5% of the global population is estimated to be living with depression right now, and that number is extremely high.

Using Data Science to Predict Microplastic Movement in Oceans

Nik Khot

Mentored by: Roger Tipton

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This project focuses on predicting microplastic movement in the Arctic Ocean using Data Science and Machine Learning techniques. The priority focus of this project is to model current distributions and forecast future trends in microplastic pollution, while also conducting a broader understanding of their sources and marine ecosystem impact. The related components of the larger research effort include cellulose extraction and microplastics characterization using disc filtration systems and FTIR spectroscopy. I created my own dataset since the one from NOAA was not as accurate as I expected it to be. I compiled and standardized data from multiple peer reviewed studies and environmental datasets I found online. Due to the scarcity and inconsistency of Arctic microplastic data, significant preprocessing was required, including mathematical conversions across sources and changing of units. I used Exploratory Data Analysis to understand the distribution of the concentrations. This revealed strong skewness and the presence of significant outliers. Boxplots were used to visualize these distributions, and GIS was used for mapping and determining which region had the highest concentration. For predictive modeling, I performed a train test split and evaluated multiple regression approaches. A RF Regressor produced a negative performance score of approximately -310, while a linear regression model yielded a score of approximately -45. These results reflect the limitations of the dataset, particularly the heavy skewness, high variance, and limited sample size despite heavy research exceeding 100 research papers and datasets. The findings highlight the challenges of applying ML to sparse environmental datasets in polar regions.

Developing Synthetic Methods Towards Selectively Fluorinated Cage Compounds

Lucy Kidd

Mentored by: Markus Etzkorn

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Synthetic organic chemistry develops reliable routes to new compounds with specific properties to investigate fundamental aspects of chemical bonding and reactivity. Specifically, cage hydrocarbons, complex compounds primarily made up of carbon and hydrogen with several ring substructures, play a significant role in this context. We are working with a literature-known cage hydrocarbon to introduce fluorine atoms into the scaffold. Fluorine, an element, is revered, especially in medicinal chemistry, for its unique reactivity because of its strong electronegative property. The preparation of the starting material has been scaled up and can now be prepared along a synthetic sequence to produce the targeted fluorinated cage compound. Our research not only establishes access to uniquely fluorinated cage compounds but also provides beneficial insight on structure and reactivity to the scientific community working in the above areas of medicinal chemistry and material science.

Discovery of Alpha Glucosidase Inhibitory Compounds from Spirodela polyrhiza (Giant Duckweed), Pistia Stratiotes (Water Lettuce), and Salvinia minima (Water Spangles) for Diabetic Treatment with Reduced Gastrointestinal Side Effects

Vihaan Kinra

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

A common product of having Type 2 Diabetes Mellitus is an abnormal glycated hemoglobin level (HbA1c), resulting from insulin resistance and beta-cell dysfunction. A current class of treatment for increased blood sugar has been α-glucosidase inhibitors, which slow down enzymes in the intestinal brush border that break down carbohydrates into simple sugars, resulting in slower glucose absorption within the body. However, the FDA-approved α-glucosidase inhibitors can cause higher amounts of undigested carbohydrates, accumulating in the colon and resulting in gastrointestinal pain. Macrophytes, plants visible to the naked eye, contain a broad spectrum of bioactive compounds that, along with inhibiting α-glucosidase, contain additional anti-inflammatory activity, potentially mitigating the gastrointestinal side effects of current inhibitors. This project aimed to study both phytochemicals and peptides isolated from three different macrophytes: Lemna minor, Elodea densa, and Salvinia minima. First, each macrophyte was oven-dried, then macerated in three solvents varying in polarity (hexane, acetone, and distilled water) to extract phytochemicals of a specific polarity for direct analysis. After, the macrophytes' proteins were precipitated via ammonium sulfate, then hydrolyzed via Alcalase to break down peptide chains from the protein extract for inhibition analysis. Preliminary results demonstrated potent inhibition by macrophyte extracts, with all 3 peptide extracts exhibiting potent inhibitory activity relative to Acarbose (positive control). Mass spectrometry analysis is anticipated to identify the phytochemicals and bioactive peptides responsible for this activity. By understanding how these natural products can offer stronger overall glycemic control, it can aid in the development of a stronger and safer α-glucosidase inhibitor.

Cocktail-Optimized Organic Acid Systems for Calcium and Carbon Transformation

Mihika Kiran

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Mineral carbonation, the conversion of dissolved inorganic carbon into stable calcium carbonate, offers a durable pathway for long-term carbon storage, and coastal seawater is a particularly promising setting given its natural abundance of dissolved bicarbonate and carbonate ions. Realizing this potential in practice, however, requires a steady, sustainable source of dissolved calcium, and this project investigates whether biodegradable organic acid cocktails, specifically citric acid, malic acid, and glycine, tested individually and in binary combination, can extract calcium from Portland cement while still supporting efficient carbonate mineralization downstream. Cement paste was crushed, sieved, and extracted under each of seven acid conditions for 24 hours, with dissolved calcium quantified by flame atomic absorption spectroscopy; the resulting extracts were then added to sodium bicarbonate solutions in both freshwater and real seawater to induce precipitation, with performance evaluated through percent yield and a seawater-to-freshwater retention ratio. Results indicate that individual glycine treatments achieved the highest calcium extraction among all conditions tested, outperforming the binary cocktails, while retention analysis shows that specific ligand treatments preserve carbonation efficiency despite the added ionic complexity of real seawater. These findings point toward a low-toxicity route for coupling cement-derived calcium reuse with coastal carbon capture, with the resulting calcium carbonate offering further potential as a reusable material in a closed-loop, circular application.

Computational Analysis of Stress Hormone Binding to Stress-Related Target Proteins

Brigitte Kittner

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Stress is a physiological response involving stress hormones that interact with proteins involved in signaling and regulation throughout the body. During chronic stress, prolonged changes in stress hormone signaling have been associated with inflammation, oxidative stress, and an increased risk of disease. Although individual stress hormones and their interactions with target proteins have been studied, it remains unclear how the predicted binding strength of different stress hormones compare across multiple stress-related target proteins. To address this gap, predicted binding strength will be determined for six stress hormones, including urocortin-2, urocortin-3, cortisol, epinephrine, norepinephrine, and corticosterone, against a selected set of human proteins associated with stress hormone signaling. Reactome and UniProt databases will be used to identify and evaluate suitable stress-related target proteins and their structures. The selected stress hormones will be analyzed against the target protein set using computational reverse docking, and predicted binding strength and molecular interactions will be compared across hormones and proteins. The expected results will identify differences in predicted binding strength among stress hormones and their interactions with multiple stress-related proteins, where strong binding values suggest a hormone-protein interaction is biologically relevant. These findings will identify how differences among stress hormones influence their interactions with proteins and therefore contribute to stress-hormone related disease.

Modulation of Heroin-Induced Dopamine Signaling by Ibogaine and Noribogaine in the Rat Nucleus Accumbens

Alexa Klein, Sierra Werner

Mentored by: Scotty McIntosh

High Point University

Ibogaine has shown promise as a potential treatment for opioid use disorder, although the neurochemical mechanisms underlying its therapeutic effects remain incompletely understood. Previous studies suggest that both ibogaine and its primary metabolite, noribogaine, contribute to its pharmacological actions. The objective of this study was to characterize extracellular concentrations of ibogaine, noribogaine, heroin metabolites, and dopamine in the nucleus accumbens following ibogaine administration and heroin challenge. Rats were implanted with microdialysis probes targeting the nucleus accumbens, and samples were collected every 10 minutes. Following a 30-minute baseline period, animals received ibogaine (10 mg/kg, i.p.) or vehicle, followed 30 minutes later by heroin (2 mg/kg, s.c.) or saline. Sampling continued for 4.5 hours. Ibogaine, noribogaine, morphine, and 6-monoacetylmorphine (6-MAM) were quantified using UPLC-MS/MS, while dopamine was measured using HPLC with electrochemical detection. Ibogaine was detected within 10 minutes of administration, peaked at approximately 10 pg/µL after two hours, and declined to approximately 3 pg/µL by the end of sampling. Noribogaine reached approximately 15 pg/µL within 50 minutes and remained between 8–10 pg/µL throughout the sampling period. Following heroin administration, 6-MAM and morphine peaked at approximately 5 and 2 pg/µL, respectively. Heroin increased extracellular dopamine to approximately 200% of baseline, whereas ibogaine pretreatment attenuated this increase to approximately 150%. Ibogaine alone reduced dopamine to approximately 50% of baseline. These findings suggest that sustained exposure to ibogaine and noribogaine modulates mesolimbic dopamine signaling and may contribute to the therapeutic effects of iboga alkaloids in opioid use disorder.

Social Information Processing and Inequality

Ryleigh Knox, Jada Clark

Mentored by: Lisa Walker

University of North Carolina at Charlotte

Social information processing in groups depends not only on the information individuals receive, but also the conditions under which that information is processed. Ensuring that participants are sufficiently task-focused and collectively oriented is therefore essential for determining whether their responses accurately reflect the social processes under investigation. However, these conditions can be difficult to establish and evaluate through the experimental procedures alone. In this study, we examine the methodological processes used to assess participants' task focus and collective orientation within a laboratory study testing the generality of the Principle of Organized Subsets. Analyzing the interviewing and debriefing procedures conducted by the research assistants, this review examines how participant responses were evaluated to determine whether individuals understood the task, remained engaged with the collective process of the interaction, and met the conditions necessary for their data to be included in analysis. Each participant will complete a 20-question assessment on "pattern sensitivity" followed by a brief interview. Synthesizing methodological approaches to participant interviewing, debriefing, and experimental data validation, this review identifies three central themes: assessing task focus, evaluating collective orientation, and identifying responses that indicate insufficient engagement with the experimental conditions. These findings suggest that interviewing and debriefing can function as important methodological checks rather than simply procedural steps following an experiment. The contribution of this literature review is to demonstrate how evaluating participant engagement can strengthen experimental validity by ensuring that data is interpreted only when the theoretical conditions underlying the study have been correctly established.

Investigating the Effect of Hyaluronic Acid and Methacrylated Hyaluronic Acid Ratios on Molecular Release

Kamalika Kollati

Mentored by: Jillian Perry

North Carolina School of Science and Mathematics

Breast cancer is commonly treated through the surgical removal of the primary tumour after diagnosis. However, even after successful surgery, residual cancer cells can remain at the surgical margins, increasing the risk of tumor recurrence and metastasis. Implantable microneedles have the potential to locally deliver immunotherapies while reducing systemic side effects. Although previous studies have demonstrated the therapeutic potential of immunostimulatory microneedle patches, this study evaluates how molecular release behaviour varies across polymer formulations containing hyaluronic acid (HA) and methacrylated hyaluronic acid (HAMA) at 1:1, 2:1, and 1:2 ratios, where HAMA is a modified polymer that forms a crosslinked hydrogel when exposed to UV light. Sulforhodamine 101 and coumarin-6 were used as the fluorescent surrogate dyes, as they modelled the key properties of hydrophilic 2′3′-cGAMP agonists and hydrophobic TLR agonists. In the initial process, fabrication of implantable microneedles through the micromolding process resulted in inconsistent needle formation. As a result, the experimental approach changed to direct evaluation of polymer formulations at time points between 5 minutes and 2 days. Data analysis showed that sulforodamine-101 exhibited an initial burst release followed by a slow release, with minimal difference observed between polymer formulations. In contrast, coumarin 6 showed very low measurable release throughout the experiment due to its poor aqueous solubility. Overall, under the conditions tested, the data did not support the hypothesis that a higher proportion of HAMA in the polymer formulation would significantly impact the release rate.

What Creative Ways Has The City of Charlotte Used To Support Urban Conservation

Naomi Kollman

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

Conservation is often thought of as protecting giant forests, wild rivers and beautiful savannahs but conservation extends far beyond those ecosystems. Conservation happens in your own backyard and is just as important. In this project, I investigate how the city of Charlotte supports urban conservation. Understanding how our local cities are supporting conservation is vital to not only local but also global conservation initiatives. The purpose of this project is to investigate what creative ways the city of Charlotte uses to support urban conservation. This project uses extensive literature reviews paired with investigating several sites in Charlotte to identify the ways in which this city supports conservation. This project is still in progress; however, I anticipate that the answer to my inquiry question will likely be that Charlotte implements several methods to support conservation including the use of green energy, urban planting, wildlife protection, and the use of local volunteer organizations. Understanding which creative ways Charlotte supports conservation is important for understanding how this city's urban conservation can grow and improve. These results will also be useful for other cities looking for ways to implement conservation in a similar manner.

Identifying Temperature-Dependent Regulation of Antibiotic Resistance in Enterococcus faecium as a Target for New Treatments.

Sandhya (Sana) Konar

Mentored by: Rebecca Guth Metzler

Queens University of Charlotte

Antibiotic-resistant Enterococcus faecium is a major cause of hospital-acquired infections, creating a need for new treatments. Temperature is one environmental condition bacteria must sense to survive during infection. Previous research shows that some bacteria use temperature-sensitive RNA structures, called RNA thermometers, to control whether proteins are produced. Identifying and disabling these thermometers could offer a strategy for treating antibiotic-resistant infections.Using computational analysis, we identified an RNA sequence in E. faecium with features resembling an RNA thermometer. This project asks two main questions: (1) Does this RNA regulate gene expression in response to temperature? (2) Can antisense oligonucleotides, short molecules designed to bind RNA, interfere with its activity?To investigate the first question, we are placing the RNA sequence in cells where its response to temperature can be measured through changes in the production of a magenta protein (mRFP). We will compare light absorbance at different growth temperatures to determine whether temperature affects protein production through this RNA. If the RNA functions as a thermometer, we will test whether designed antisense oligonucleotides disrupt its activity and alter protein production. These experiments are expected to establish whether the RNA acts as a temperature-sensitive switch and whether its function can be disrupted. The findings could help identify a target for developing treatments that interfere with bacterial adaptation during infection, offering a potential approach to combating antibiotic-resistant E. faecium.

Comorbidities and Treatment Patterns in Adult ADHD: A 97-Patient Retrospective Analysis

Khushi Konda

Mentored by: Devendra Shah

North Carolina School of Science and Mathematics

Attention-Deficit Hyperactivity Disorder (ADHD) frequently persists into adulthood and is often accompanied by comorbid conditions that can complicate treatment plans and create difficulties in ADHD management. This study examined the treatment patterns, coping strategies, and comorbid conditions that are prevalent among adults with ADHD. Age-related trends are especially emphasized in order to understand treatment strategies and symptoms in different stages of life. A descriptive, retrospective observational analysis was conducted based on 97 anonymous, de-identified adult ADHD patient charts from a private psychiatric clinic. Charts were reviewed under the supervision of a licensed psychiatrist and categorized by variables into aggregate data. Data were extracted from patient records, organized manually, and analyzed using Google Sheets based on variables such as medication use, symptom patterns, and comorbid conditions. Approximately 88% of patients had at least one comorbid condition, with anxiety being the most common, followed by depression and insomnia. Comorbidities were associated with more complex treatment plans, a more variable medication success rate, and increased therapy reliance. Age-related patterns suggested greater symptom and treatment stability in older adults, while these variables showed more variation among younger patients. The findings of this study highlight the importance of an individualized, multimodal treatment plan for adult ADHD management.

Composition of aquatic macroinvertebrate populations as indices of water quality on small retention ponds in Anson and Union County, North Carolina

Momo Kong, Anna Hernandez, Mac Looney

Mentored by: Chasity Moore

South Piedmont Community College

This study set out to establish a biodiversity monitoring system for the freshwater systems in Anson and Union County, North Carolina. Establishing this monitoring system will serve as a precedent for future biological assessments so long term studies can be performed. Previous surveys of this area focused on large bodies of water designated for municipal use or are so antiquated any applicable data would be rendered obsolete. The data collection in this biological survey was focused to the small retention ponds found on South Piedmont Community College (SPCC) campuses. Population counts of macroinvertebrates and water quality parameters were taken at each sampling site. Macroinvertebrates were collected via grab sample and dip netting. Water temperature, pH, dissolved oxygen, conductivity, nutrient prevalence, and turbidity were measured. The surrounding environment was visually surveilled for factors that may indicate certain conditions pertaining water quality. The Hilsenhoff formula was used to determine a family biotic index (FBI) score for each of the retention ponds (Monroe: 5.75, Polkton: 7.72). These results suggest the pond on the SPCC Monroe campus had better water quality but less biodiversity than the SPCC Polkton campus.

Healing Through Music: The Benefits of Music Therapy for Individuals with Parkinson's Disease

Katelyn Koon

Mentored by: Vaughn Schmutz

University of North Carolina at Charlotte

Music therapy provides a wide range of physical, social, and emotional benefits, increasing patient confidence and improving quality of life through social connection, rhythm, balance, and stress relief. However, despite its many benefits, fewer than 1% of the U.S. population receives music therapy services each year. Piedmont Music Therapy (PMT) is a local nonprofit organization that works to expand access to clinical music therapy in individual sessions and group settings for a variety of clients, including those diagnosed with Parkinson's disease. In this study, I examined how music therapy can address physical, mental, and social challenges associated with Parkinson's. My methods included direct observation of sessions offered by PMT and self-reports that document improvements in speech, confidence, balance, and gait in individuals diagnosed with Parkinson’s disease. Previous research indicates that regular exercise, social connection, dance, and music can help alleviate symptoms associated with Parkinson’s disease such as freezing of gait, impaired balance, facial masking, and diminished muscle control. This study highlights the importance of music therapy and its benefits in improving symptoms associated with Parkinson's disease, emphasizing the need to make music therapy more widely available, incorporate it regularly into treatment plans, and encourage community initiatives to increase access and awareness.

Validating an Automated Docking Pipeline for Antibody Cross-Reactivity Across Viral Families

Srikritha Kosuri

Mentored by: Denis Jacob Machado

University of North Carolina at Charlotte

This project evaluates the ability of the protein-protein docking AVOIDRUNE pipeline to reliably and efficiently process large structural datasets with prospective applications in drug and preventive medicine development. Computational docking is used in structural biology and drug discovery to predict interactions between molecules, but using docking with large datasets creates challenges in computational efficiency and scalability. Existing bioinformatics tools focus primarily on manual execution of docking predictions and are not adapted for throughput, resource utilization, and reliable execution across multiple docking jobs. AVOIDRUNE is intended for large-scale analysis, so its ability to process potentially terabytes of input data must be tested to ensure reliability and reproducibility. This project will scale the AVOIDRUNE docking pipeline using a dataset of antibody-receptor structures across Coronaviridae, Flaviviridae, Orthomyxoviridae, and negative control viruses, running batch tests on the UNC Charlotte HPC cluster using containerized workflows and SLURM. Pipeline parameters, runtime, and failure modes will be tested and documented, and prediction outcomes will be compared against established benchmarks to assess overall workflow accuracy and usability. By the end of the Fall 2026 term, this project will produce a written report and oral presentation with slides, documenting pipeline performance, parameter validation, and bugs encountered under scaled loads, along with an answer to whether binding affinity with viruses holds with statistical support. It will also produce a documented, reproducible HPC workflow and performance benchmark for AVOIDRUNE, contributing a substantive finding on antibody cross-reactivity and a practical improvement to the pipeline's scalability and reliability.

NPFR1 Signaling in Alcohol-Driven Behavior in Drosophila melanogaster Toward Opioid-Independent AUD Pharmacotherapies

Ruhan Kothare

Mentored by: Heather Mallory

North Carolina School of Science and Mathematics

Alcohol use disorder (AUD) affects 400 million people worldwide and contributes to 2.6 million deaths annually, yet only three pharmacotherapies are FDA-approved, and first-year relapse rates reach 80%. Existing medications act broadly across receptor systems rather than engaging the circuits that drive compulsive alcohol seeking. In mammals, neuropeptide Y (NPY) signaling constrains alcohol intake, and reduced NPY expression is associated with greater vulnerability to dependence. Its functional homolog in Drosophila melanogaster, neuropeptide F receptor 1 (NPFR1), permits circuit-specific manipulation of that constraint. This project pursues two aims. The first asks whether reducing NPFR1 signaling increases addiction-like alcohol seeking. GAL4/ UAS-driven RNAi knockdown in NPFR1-expressing neurons is compared with wild-type and parental genotype controls across capillary feeder assays of ethanol consumption, quinine-adulterated capillary feeder assays of aversion-resistant alcohol seeking, and vapor exposure assays of sedation latency, with locomotor and bitter-taste assays controlling for non-specific effects. Knockdown flies are expected to consume more ethanol, to continue consuming it despite quinine adulteration, and to resist ethanol sedation, indicating that NPFR1 signaling constrains alcohol seeking under aversive conditions. The second aim asks whether naltrexone, the most widely prescribed pharmacotherapy for AUD, requires intact NPFR1 signaling to suppress ethanol preference. Because D. melanogaster lacks opioid receptors, any behavioral effect of naltrexone here is necessarily independent of its canonical target. Naltrexone is expected to reduce and to show an attenuated effect in knockdown flies, identifying neuropeptide signaling status as a determinant of naltrexone response.

Parental Psychological Control and Adolescent Depressive Symptoms in Chinese Families: The Roles of Parent-Parent Gender Dyad

Jordan Krause, Shanhong Luo

Mentored by: Shanhong Luo

Fayetteville State University

Although adolescent mental health has been found to be associated with parents' use of psychological control, previous studies have not examined how the association may differ across gender dyads of parents and children. Moreover, few studies have considered the joint influences of both mothers' and fathers' psychological control on adolescent depressive symptoms. The current study was designed to address these limitations in a large Chinese adolescent sample. Participants included 3069 Chinese adolescents who rated their depressive symptoms as well as their mothers' and fathers' use of psychological control. Results revealed that mothers' psychological control was consistently positively associated with adolescent depressive symptoms. The positive association between fathers' psychological control and children's depressive symptoms was significant when mothers' psychological control was low but not when it was high. Moreover, the positive association between fathers' psychological control and children's depressive symptoms was significant for daughters but not for sons. Findings from this study provide a more nuanced understanding of the role that gender dyads within Chinese families may play in the link between parental psychological control and adolescent depressive symptoms. They highlight the importance of considering both parents when addressing Chinese adolescents' mental health issues.

Food Allergies and Their Effects on Grocery Price Disparities and Purchasing Patterns

Connor Kresock

Mentored by: Rivin Perinchery

High Point University

This research quantitatively identifies a significant price premium for allergy-friendly(AF) goods relative to their conventional counterparts, and the resulting effects on household grocery purchasing decisions and weekly expenditures. We collected price data for conventional milk and flour goods, along with their AF counterparts. We also administered a survey of household grocery shoppers, collecting both qualitative and quantitative data on grocery purchasing patterns. We find that households shopping for AF counterparts spend significantly more per week than households that do not. We consider how AF households adapt their consumption patterns in light of the AF premium, yet still find themselves paying more than non-AF households. The analysis of the AF price premium on household behavior is ongoing.

Reframing or Letting Go? Comparing Cognitive and Mindfulness Strategies for Self-Criticism on Heart Rate Variability

Jadyn Kuenzel

Mentored by: Laura Nagy

High Point University

Self-criticism is a negative judgement of oneself, often involving feelings of worthlessness, inability, and inadequacy (Zaccari et al., 2024). Engaging in more self-critical thinking is associated with a physiological stress response, which is associated with worse health outcomes (Rockliff et al., 2008). Cognitive behavioral therapy (CBT) is a psychotherapy for self-criticism that works by helping people identify, evaluate, and correct dysfunctional beliefs about themselves (Ezawa & Hollon, 2023). Mindfulness-based therapies emphasize teaching clients to detach from negative thought patterns and increase self-compassion, rather than changing maladaptive self-critical thoughts (Gkintoni et al., 2025). Mindfulness-based strategies for treating self-criticism, including Compassion Focused Therapy (CFT; Gilbert, 2010) have been shown to improve heart rate variability (HRV; Matos et al., 2017). Higher levels of resting HRV are associated with better mental health, and HRV reactivity during stressful situations is considered to be a physiological index of healthy engagement with a stressor (Balzarotti et al., 2017). Individuals with lower levels of self-criticism have been shown to have significantly higher HRV (Halamová et al., 2019). The present study aims to compare the effectiveness of cognitive restructuring versus practicing mindfulness in reducing the physiological effects of self-critical thoughts, measured as HRV. Previous studies have found both treatments to be effective in lowering self-criticism, albeit via different mechanisms (Levin et al., 2018). Data collection is under way, but because mindfulness practices involve more calming breathing techniques, it is hypothesized that the mindfulness task will be slightly more effective at increasing HRV than the cognitive restructuring task.

Same Dynamics, Different Structures in Energy-Preserving Operator Fits

Pranava Kumar

Mentored by: Manolis Kellis

North Carolina School of Science and Mathematics

Energy-preserving reduced-order models can reproduce observed trajectories even when the coefficients describing their internal structure are not uniquely determined. We study this structural identifiability problem for quadratic energy-preserving dynamics. For the model class considered here, a single quadratic energy leaves a coefficient null space of dimension $\binom{d}{3}$, independent of the amount of trajectory data. On published 2D Burgers data, two admissible fits differ by 68% in coefficient norm while their vector fields differ by only $6.2\cdot10^{-14}$. For Lie-Poisson models, we further determine whether these undetectable coefficient changes are only changes of basis or can produce non-isomorphic Lie brackets with the same dynamics. This leads to an identifiability certificate that determines whether enforcing the Jacobi identity can recover the coefficients or whether a second experiment with a different energy is required. Under Gaussian observation noise, we calibrate the numerical rank test using the predicted coefficient uncertainty and abstain when the rank is unresolved. A high-probability bound then gives the trajectory count required for a specified coefficient error.

The Rights Violations and Transitional Justice Outcomes Cross-National Dataset

Saanvi Kumar

Mentored by: Mara Revkin

North Carolina School of Science and Mathematics

Transitional justice mechanisms are policies used by states and non-state actors to address systemic violations of human rights. Prior studies have found inconclusive results when analyzing how the design of transitional justice mechanisms influence regime durability. Previous cross-national datasets rely on binary variables and focus on post-war or post-authoritarian rule countries, failing to capture nuances of transitional justice mechanisms across all countries. This study compiles a detailed dataset of countries listed in the UCDP (The Uppsala Conflict Data Program), GTD (Global Terrorism Database), and CIRIGHTS (Cingranelli-Richards International Rights Data Project) datasets that are involved in inter-state conflict and have authoritarian regimes, including those countries without transitional justice, enabling counterfactual comparison and broadening the scope of countries analyzed. Using primary source documents such as laws and secondary source documents such as UN agency reports, this project codes transitional justice variables for each country. Initial coding has revealed that transitional justice varies systematically across countries, but overall, leads to peace post-conflict. Further regression analysis using R will estimate how the design of transitional justice mechanisms correlates with regime stability, peace, and democratization. The resulting polity metrics will show how the design of transitional justice mechanisms influences democratization, regime stability, and peace durability. The dataset will be complemented by public-opinion surveys and focus group discussions in three countries: Colombia, Iraq, and Ukraine. The resulting quantitative dataset will support policymakers globally in evaluating the effectiveness of existing transitional justice mechanisms and provide a foundation for further quantitative or mixed-methods research.

Condensed SIR Modeling on Residential School Contact Networks

Satvik Kunam, Pranav Yaramalla

Mentored by: Hannah Schwartz

North Carolina School of Science and Mathematics

Most disease-transmission models assume everyone has an equal chance of interacting with everyone else. However, in a residential setting, students live with roommates, share halls with hallmates, and interact with students from other halls only in certain places, such as the cafeteria or gym. Past studies have shown little effect in day schools, but this has not been tested in boarding schools. Our project will test whether interactions among students living with others affect disease spread and, if so, to what extent. We used a computer model of the North Carolina School of Science and Mathematics at Morganton (NCSSM) that tracks the number of students who are healthy, sick, or recovered in each of the eight dorm halls, as well as how the disease travels between shared spaces. The computer model will be based upon a survey that asks students how they interact with certain people and places. We will then derive a formula to determine the contagiousness required to spread a disease throughout the school, and compare the model's results with a simplistic model and another model that tracks every individual and their roommates. We predict that halls alone will have little effect, but roommates will have a large effect, since students will spend most of their time with their roommate, who has likely already been infected if the room has been infected. This study can provide insight into how diseases are spread in boarding schools and what shared spaces are most important to check during an outbreak.

Dark Triad Traits by Religious Identity and Gender Among College Students

Brandon Labar, Gabrielle Hickey

Mentored by: Sieun An

Fayetteville State University

The Dark Triad comprises Machiavellianism, narcissism, and psychopathy, personality traits associated with manipulation, grandiosity, and low empathy. This study examined whether Dark Triad traits differed by religious identity and gender using survey data from 2,466 college students. The analytic sample included 2,152 participants who reported their gender as male or female, had complete Dark Triad scores, and identified as Christian (n = 1,420), spiritual but not religious (n = 326), agnostic (n = 229), or atheist (n = 177). Participants identifying as Jewish, Muslim, or Buddhist were excluded from group comparisons because the individual group sizes were too small for reliable analysis. Dark Triad traits were assessed using an adapted Short Dark Triad measure. The analyses compared the three traits across religious-identity and gender groups and examined whether gender differences varied by religious identity. Agnostic and atheist participants scored lower on narcissism than Christian and spiritual-but-not-religious participants. Spiritual-but-not-religious, agnostic, and atheist participants scored higher on psychopathy than Christian participants. No significant religious-identity differences were found for Machiavellianism after correcting for multiple comparisons. Male participants scored higher than female participants on all three traits, although the differences were small. Gender differences did not vary significantly across the four religious-identity groups. The pattern of differences among religious-identity groups varied across Machiavellianism, narcissism, and psychopathy.

Producing gRNA Inserts for Regulation of Genes Associated with Obesity

Cole Lapcevic

Mentored by: Caroline Hoffman

Wake Technical Community College

Fibronectin domain III-containing protein 3B (FND3CB) is a gene that is hypothesized to positively regulate differentiation of preadipocytes to adipocytes(Kishimoto et.al, 2010). Higher waist to hip ratios (WHR) are thought to be associated with higher expression levels of FND3CB. Researchers at UNC Chapel Hill Mohlke Laboratory will test the hypothesis that the FND3CB gene is responsible for elevated WHR by removing noncoding regions of DNA around the gene by introducing a viral payload containing both CRISPR-CAS9 complex, a bacterial enzyme capable of functioning as ‘molecular scissors', and guide RNA that will tell the CRISPR-CAS9 complex where to 'attach' (Mohlke, 2025). For this experiment, guide RNA (gRNA) is designed and produced that will tell the CRISPR-CAS9 complex where to 'attach' for researchers at UNC Chapel Hill Mohlke Laboratory to determine if silencing certain regions of DNA affect downstream expression of FND3CB.

Quantifying the Association of Individual and Neighborhood ITN Use with Malaria Among Children Under Five in Ghana and Nigeria: A DHS-VII and DHS-VIII Analysis

Hannah Larbi, Mercy Agbai

Mentored by: Carolina Perez-Heydrich

Meredith College

Malaria remains a major public health concern, especially among children under five in Ghana and Nigeria. Insecticide-treated nets (ITNs) are widely used to help prevent malaria, but previous research suggests that ITN use alone does not fully explain malaria risk. Other factors,including maternal education, household conditions,and environmental factors,may also contribute. Our study examined the associations between individual ITN use, neighborhood ITN use,and malaria among children under five and assessed whether these associations were consistent across Ghana, Nigeria,and Demographic and Health Survey (DHS) VII and VIII. We analyzed the DHS-VII &VIII data using R. Malaria status was based on rapid diagnostic test results, individual ITN use on whether the child slept under an ITN the previous night,and neighborhood ITN use on the percentage of ITN use within the child's community cluster. Chi-square and Welch's t-tests were used to assess selected variables from the DHS recode manual,with variables having $p < 0.05$ identified as potential confounding factors. Crude logistic regression was used to examine the relationship between ITN use and malaria before accounting for potential confounding factors. After,adjusted logistic regression was used to determine whether the relationship remained after accounting for these factors. The crude analyses showed higher odds of malaria among children who used ITNs, but that association was no longer significant after adjustment. Neighborhood ITN coverage showed small associations with malaria that varied across countries and survey waves. Overall,our findings suggest that ITN use should not be considered alone when studying malaria prevention,as socioeconomic,household,and environmental factors also play an important role.

Understanding seismic activity in the Appalachians of North Carolina

Sierra Lawson

Mentored by: Zhigang Peng

North Carolina A&T State University

On August 9th in the year 2020, an earthquake of magnitude 5.1 occurred in Sparta,North Carolina. The earthquake occurred on a newly discovered fault, the Little RiverFault. With the data collected from this earthquake and its many aftershocks andtriggered events, I will plot the waveforms to see the primary and secondary wavearrivals. With this, I used shear-wave splitting analysis to determine the fast and slowdirections of the waves and plot their particle motion. Using this, we can study thewaves' directional movement in reference to the seismic stations and plot saiddirectional movement on a map. This will help to understand any future activity that willoccur in the region

Optimizing the method to determine pharmaceutical potential of phytoplankton: exploring the effects of nutrient stress on phytoplankton metabolite production

Nina Le

Mentored by: Poulin X. Remington

University of North Carolina at Wilmington

Phytoplankton, microscopic unicellular marine organisms, chemically defend themselves against competitors and predators through a process known as allelopathy. Due to close evolutionary linkages between specific phytoplankton species and disease-causing human parasites, it is hypothesized that these plankton-derived secondary metabolites could serve as a valuable source for novel antiparasitic therapeutics. To address this hypothesis, we optimized our in-house potency bioassay to establish a reliable pipeline for candidate drug identification. This validation process required evaluating and selecting optimal carrier solvents for both endometabolomic cellular extracts and exometabolomic extracellular exudates to eliminate solvent-induced cytotoxicity. Additionally, we refined test compound exposure dynamics across a comprehensive 14-day incubation timeframe. In this presentation, we highlight the complete methodological protocol designed to transition phytoplankton cultures from primary growth through chemical extract screening. Ultimately, this standardized bioassay provides a robust, reproducible platform for discovering marine natural products and accelerating the development of novel parasite-targeted clinical therapeutics.

A Pilot Study: Exploring College Students' Perceptions of a Future Campus Garden's Role and Fruit Tree Initiative in Addressing Food Insecurity and Promoting Student Well-Being

Larensa Leak

Mentored by: Dennis Corbin

Fayetteville State University

Food insecurity continues to affect students in higher education, particularly within the Mid-Atlantic region, where limited food access and rising living costs influence academic performance, stress levels, and well-being. Many campuses operate as food deserts, leaving students dependent on fast food, convenience stores, or vending machines for daily meals. This pilot study explores whether a future campus garden and fruit-bearing trees could serve as a sustainable, student-centered strategy to improve food access and support student well-being. Using a quantitative design, the study examines college students' perceptions of campus gardens and fruit-bearing trees as a tool for addressing food insecurity and their willingness to participate in garden-related activities. Data will be collected through an anonymous survey administered at an on-campus recruitment table, including the USDA Six-Item Short Form to assess food insecurity, along with items measuring well-being and attitudes toward campus-grown food. Findings from this study aim to provide evidence-based recommendations for developing a campus garden and fruit-bearing tree initiative that enhances student well-being, strengthens community engagement, and expands access to fresh, affordable produce. Results may also guide other institutions seeking low-cost, sustainable, and community-driven approaches to addressing student food insecurity.Keywords: food insecurity, campus gardens, fruit trees, student well-being, sustainability, higher education

Family Stressors Linked to Mental Health in Young Adulthood, Modified by Caregiver-Child Relationships.

Sydney Leake

Mentored by: Aura Mishra

North Carolina State University

Previous research indicates that negative household environments contribute to poorer adolescent mental health, but that factors such as parental care can act as a potential buffer. We hypothesize that while household chaos is negatively associated with adolescent mental health, caregiver-child relationships would be positively associated with adolescent mental health. The Future of Families & Child Wellbeing Study (FFCWS) dataset was utilized to determine the household chaos, mental health, and caregiver-child relationships of the youth at wave 15. FFCWS is a contemporary U.S. birth cohort study of young adults based on a national sample of approximately 5,000 children. The study follows a multistage, stratified, city-based probability sample, collecting data at time points 1, 3, 5, 9, 15, and 22. We conducted multiple regression analyses and found an association trending towards significance between higher household chaos and higher depression ($\beta=0.137$, $p<0.075$), and a statistically significant association between a stronger caregiver-child relationship and lower depression ($\beta=-0.553$, $p<0.001$). Furthermore, we found an association trending towards significance between higher household chaos and higher anxiety ($\beta=0.180$, $p<0.056$), and a statistically significant association between a stronger caregiver-child relationship and lower anxiety ($\beta=-1.018$, $p<0.001$). Uncovering this relationship is crucial to pointing to interventions that aim at improving adolescents' mental health. Future directions include exploring if there is also a gender difference associated with this relationship.

Investigating Dietary Influence on T-Cell Response to ART in Acute HIV

Brielle Lee

Mentored by: Julie Mannarino

North Carolina A&T State University

Important indicators of HIV progression and immune health are CD4 and CD8 T-cell counts. Acute HIV infection causes rapid immune disruption and early recovery of CD4 and CD8 T-cell counts. Although sociodemographic conditions can influence the quality of diets in Thailand, limited research has examined whether diet influences T-cell responses among people living with acute HIV. This study aimed to evaluate the effects of dietary patterns on immune function over 24 weeks among people living with acute HIV on antiretroviral therapy in the RV254 cohort. A subset of 60 participants from the RV254 cohort in Bangkok, Thailand, were selected, including 30 participants who followed a specific diet at week 0 that were compared to 30 age-, sex-, and BMI-matched participants who did not report a specific diet. Changes in CD4 and CD8 T-cell counts from baseline to week 24 were analyzed using nonlinear mixed-effects modeling with post-hoc testing. At baseline, CD8 counts differed between groups and showed significantly different trajectories. There was no significant difference in CD4 counts and the CD4/CD8 ratio, both showed an increase after baseline. Although modest in strength, this study suggests certain diets may influence T-cell response and have differential impacts on T-cell recovery during the acute stage of HIV in people taking antiretroviral therapy.

Breaking Barriers in Vaccine Injury Compensation: A Data-Driven Analysis of Success Rates and Challenges

Olivia Lee

Mentored by: Dohyun Lee

North Carolina School of Science and Mathematics

The U.S. National Vaccine Injury Compensation Program (VICP) provides compensation for individuals who experience certain vaccine-related injuries, but the claims process can be difficult to navigate. This study evaluates compensation success rates across selected vaccine categories, identifies major barriers to successful claims, and examines practical strategies for improving claimant outcomes and system accessibility. VICP adjudication data for petitions filed from 2006 through 2021 were analyzed by calculating compensation success rates as compensable outcomes divided by total adjudicated petitions, with 95% Wilson confidence intervals used to assess uncertainty. Influenza, Tdap, and Td showed success rates of 84.82%, 82.09%, and 76.61%, respectively, while MMR, HPV, and DTaP-IPV-Hib showed rates of 49.67%, 32.25%, and 30.00%. The current study identified limited public awareness, complex filing procedures, extensive documentation requirements, difficulties establishing causation, and the need for medical and legal expertise as major challenges. The research also highlighted the importance of the Vaccine Injury Table, expert testimony, and legal precedent in strengthening claims. A sensitivity analysis using the HRSA Monthly Statistics Report updated June 1, 2025 extended the comparison through petitions filed in 2023 and showed broadly similar results. Based on these findings, the study recommends simplifying filing procedures and improving transparency, while emphasizing thorough medical documentation, credible expert testimony, and relevant legal precedent as practical strategies for navigating the compensation process.

Battle in the Bull City: The Long Fight for Desegregation in Durham Public Schools

Zora Lentz

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Following a series of failed desegregation measures, Durham, North Carolina's separate city and county school districts merged in 1992, creating a unified Durham Public Schools (DPS) system. The project seeks to use the historical context of this merger and its lasting effects to understand modern-day conversations around school desegregation. The respective North Carolina Collections at the Durham County Library and at Wilson Library at the University of North Carolina as well as online sources like DigitalNC will be crucial for sourcing The Carolina Times, a Black Durham newspaper and other primary sources. A broader literature around Durham's Black freedom struggle and desegregation, like Christina Greene's Our Separate Ways, as well as demographic and school rezoning information will be crucial, too. This project will likely find parallels between past and present efforts to make the Durham school system fairer for all, with aspects like neighborhood zoning and class distribution playing large roles in conversations around equitable school systems. DPS continues today to work through the lasting effects of segregation, and this project will provide historical context as to why these effects are so persistent in Durham.

A novel SCA-linked CHIP mutation fails to suppress polyglutamine aggregation in a cellular model

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Mentored by: Jonathan Schisler

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Spinocerebellar ataxia (SCA) is a hereditary neurodegenerative disease of the cerebellum that impairs motor coordination, gait, balance, and cognition. Several forms of SCA are linked to mutations in STUB1, which encodes the protein CHIP, underscoring its central role in these disorders. CHIP is a key regulator of protein quality control (PQC), a system frequently compromised in neuronal cells, allowing protein aggregates such as polyglutamine (PolyQ) species to accumulate. Our lab identified a novel STUB1 mutation, p.Ser216Pro (S216P), in a patient with cerebellar ataxia. Structural modeling predicts that this mutation destabilizes the coiled-coil domain of CHIP required for its interaction with Hsp70. We therefore hypothesized that S216P causes a loss of CHIP function, impairing its ability to maintain proteostasis and suppress PolyQ aggregation. CHIP-null COS7 cells were transiently co-transfected with empty vector, CHIP-WT, or CHIP-S216P, alongside a PolyQ construct of either 23 (non-pathogenic) or 74 (aggregation-prone) repeats. Twenty-four hours after transfection, cells were fixed and immunostained for CHIP (myc tag) and PolyQ (eGFP tag). Aggregates were visualized by fluorescence microscopy and quantified in Fiji (ImageJ). CHIP-WT markedly suppressed PolyQ74 aggregation relative to empty vector, confirming its protective role in PQC. In contrast, cells expressing CHIP-S216P accumulated PolyQ74 aggregates, with formation accelerated compared with empty vector. PolyQ23 produced minimal aggregation across all conditions. These findings indicate that S216P is a loss-of-function mutation compromising CHIP-mediated clearance of PolyQ protein. Future work will test CHIP–Hsp70 binding by co-immunoprecipitation, assess ubiquitin ligase activity in vitro, and extend these experiments to neuronal and patient-derived models.

Evaluation of Data Correction Methods in Determining Period-Luminosity Relations Across Pulsating Variable-Star Classes from GAIA DR3

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Mentored by: Judit Ries

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We present an analysis of two data correction methods for improving period-luminosity (P-L) relations of pulsating variable star classes observed by the European Space Agency's (ESA) GAIA Space Observatory.While P-L relations themselves are well-established in the field of stellar astrophysics, our work aims to examine the relative efficacies of different correction methods used to obtain said relations. The GAIA Vari Citizen Science open classification system provides an interface for classifying different variable star candidates based on light curves and Hertzsprung-Russell (HR) diagram positions. Using this interface, we classified 423 objects: 174 pulsating variables, 96 long-period variables (LPVs), 122 binaries, and the rest undetermined. Our classifications showed weak P-L relations for all four pulsating variable classes with large scatter that would not give reliable distances.Next, we looked at data on these variable star types from GAIA Data Release 3 (GDR3), which had additional data such as color index and classification subtypes. Using these data, we applied corrections to the distance based on reddening and zero-point corrections to determine their effect. R2 values were calculated for each P-L regression and used to quantify the improvements. Our results show that calculating Wesenheit magnitude to account for reddening is the most important correction. Comparatively, zero-point parallax correction did not result in substantial improvement.

From Enzyme to Field: A Multi-Modal Approach to Combating Fusarium oxysporum Through Cdc14 Inhibition, Nanoparticle Delivery, and AI-Based Detection

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Mentored by: Latha Shankar

Chantilly High School

Diseases caused by fungi are one of the biggest causes of crop losses and food insecurity due to increasing levels of pesticide resistance. As Cdc14 phosphatase inhibits fungal growth, this project sought to find the most effective inhibitor of Cdc14 protein in Fusarium oxysporum (Fo), and to find delivery and detection methods. The protein was selected via bioinformatics approach, expressed and purified using Akta chromatography, and quantified via BSA standard curve. The most effective inhibitor and conditions were found by using steady-state kinetics, substrate standard curve, and MOE docking. Aurintricarboxylic Acid (I1) and 2'-hydroxy-1,1'-binaphthalene-3,4-dione (G7) inhibitors showed 99.98% and 99.12% inhibition with IC50 values of 4.1 μM and 14.5 μM respectively. This result shows that I1 inhibitor is the most potent Fo Cdc14 inhibitor, which was subsequently modeled in MOE to optimize active site interaction. Carbon dots produced via microwave-assisted pyrolysis were delivered to plant stems and detected via fluorescence imaging over 48 hours, which showed that there is systemic movement. Furthermore, a computer vision model (EfficientNet-B0) successfully recognized infected tomato leaves from visually similar conditions achieving 94.8% test accuracy and a macro F1 value of 0.928. Recall of Fusarium infection is 82.4%, increasing from 66.7% at early-stage symptoms to 96.2% at late stages, with calibrated false positive treatment rate of 1.7%. Future work includes testing optimized inhibitors, increasing sensitivity of detection, as well as testing carbon dot conjugation. Limitations include possible pipetting errors and contamination of samples.

Understanding the molecular determinants for heat -induced Mpk1 kinase localization

Emma Light

Mentored by: Megan Mitchem, Andrew Truman

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Eukaryotic cells depend on signaling and proteostasis networks to adapt to stress. The Saccharomyces cerevisiae MAP kinase Mpk1 (Slt2) is a central regulator of the Cell Wall Integrity (CWI) pathway, but its behavior during acute heat stress suggests an unexpected role in stress granule formation. We find that Mpk1 rapidly redistributes from the nucleus to cytoplasmic puncta, where it colocalizes with the stress granule protein Pab1. Granule localization does not require kinase activity, dual phosphorylation, or the disordered C-terminal tail, indicating that intrinsic features of the kinase domain are sufficient to drive condensation. Pab1 condensation-defective mutants increase the number of Mpk1 foci, suggesting that Mpk1 can self-associate but depends on Pab1 for assembly into mature granules. Ongoing studies using in vitro reconstitution, analog-sensitive kinase assays, and proximity labeling (TurboID) aim to identify Mpk1 regulatory partners and define their roles in this process. Together, these findings connect MAP kinase signaling to heat stress-induced stress granule dynamics and broaden our understanding of how cells integrate signaling and proteostasis during stress.

Investigating the role of cognitive hierarchical relationships on color-concept associations

Rana Gabrielle Ligue

Mentored by: Melissa Schoenlein

High Point University

We often associate colors with concrete and abstract concepts (e.g., associating reds with the category “fruit”). However, our understanding of how people learn these color-concept associations remains limited. Previous color research shows that people develop color-concept associations through experiences. Studies also demonstrate that concepts are organized hierarchically with a relationship between superordinate (broad) and basic-level categories. Building on these studies, the present research investigates how individuals form hierarchical structures of color-concept associations for abstract and concrete concepts. Specifically, we are testing whether basic-level categories determine the pattern of associations for superordinate categories, and whether the typicality of basic-level categories influences this relationship. For example, the typicality of apples could prompt associating red with fruits more strongly than browns of coconuts. In the learning task, participants learn about different novel categories and are told that objects in each category typically appear round or linear; then they categorize the objects. Participants next complete an association task in which they are asked how strongly they associate object names with colors. We expect that the colors of the typical objects will have the greatest influence on the colors associated with the broader category. This research contributes to our understanding of how we learn and reason about colors, which can help us communicate more effectively.

Mathematical Measures for Gerrymandering: An Introduction to Ensemble Analysis with Markov Chain Monte Carlo

Yoojin Lim, Saad Malik, Alexander Reynolds, Violet Schnabel

Mentored by: Mick Stukes

Central Piedmont Community College

Districting can influence election results by keeping together communities that share a race, ethnicity, or political affiliation or by splitting them into different districts. Intentionally drawing districts in these ways to favor a political party or a demographic group is called gerrymandering. One way to detect gerrymandering is ensemble analysis, which uses Markov chain Monte Carlo (MCMC) to sample an ensemble of legally valid maps and tests an enacted map by comparing it to this ensemble. We apply a widely used MCMC sampling method called Recombination (ReCom) to illustrate this approach, using the enacted North Carolina district maps as a worked example. We generate an ensemble of maps, measure features related to assessing gerrymandering for each map, and locate an enacted map within the resulting distributions; if the map falls in the tails of at least one of the distributions (i.e., is an outlier), we identify it as evidence of gerrymandering. Through this example, we aim to give readers without a mathematical background, such as those in political science and law, an accessible explanation of what ensemble analysis does in detecting gerrymandering and how its results can be interpreted.

Geminiviruses infectious clone production from solanaceous plants

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Mentored by: Trino Ascencio-Ibáñez

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Viruses found within the plant virus family Geminiviridae are known pathogens that devastate crop production worldwide. Building upon previous findings from wild Physalis and other solanaceous samples collected in Mexico, the project has advanced in the identification and verification of candidate viral genomes in preparation for infectious clone production. Previously identified positive samples were reanalyzed using RCA (Rolling Circle Amplification) and PCR with degenerate primers (CPMot/RepMot). Agarose gel electrophoresis was used to identify and visualize any positive candidates for downstream application. Currently, we are repeating RCA amplifications that rendered inconclusive results and will attempt the partial digestion to generate dimers for cloning. Once the dimers are cloned will be sequenced for verification and tested against tomato Lanai to verify infectivity.

Green Synthesis of Folic Acid-Functionalized TiO2-Bi2O3 Nanohybrids as a Sonosensitizer for Enhanced ROS Production in Sonodynamic Therapy

Vivien Lin

Mentored by: Timothy Anglin

North Carolina School of Science and Mathematics

Many modern cancer therapy methods struggle with effectively eliminating deep tissue and bone tumors, such as pancreatic adenocarcinoma and glioblastoma, due to harmful side effects and cellular toxicity. Recently, studies have identified Sonodynamic Therapy (SDT) as a promising alternative to these therapy methods: ultrasound penetrates deep into the body, and sonosensitizers can be modified to achieve various beneficial properties. In this work, TiO2-Bi2O3 nanoparticles (TiBi NPs) were synthesized with bismuth (III) nitrate pentahydrate and titanium (IV) isopropoxide as metal precursors. Acorus calamus root extracts were used as a reducing agent to decrease chemical toxicity and environmental harm. Then, ROS production from TiBi NP irradiated under 365 nm light, which mimics sonoluminescence, was tested via a 9,10-Anthracenediyl-bis(methylene)dimalonic acid (ABDA) assay for singlet oxygen and a modified FOX assay for hydrogen peroxide. A KI-starch test was conducted to measure general ROS production, and an antimicrobial zone of inhibition assay was conducted via the agar diffusion method on K12 E. coli cultured in LB broth. It was discovered that the incorporation of bismuth into TiO2 NPs lowered the particle band gap from 3.2 eV to 3.07 eV. The ROS production of these nanoparticles has not yet been tested, although further research should conclude that they produce more ROS compared to non-modified Bi2O3 and TiO2 nanoparticles. TiBi NPs should also demonstrate antimicrobial properties, introduced by the incorporation of A. calamus into synthesis.

Exploring Biorenewable Chlorinated Derivatives of PTQ-10 for Organic Solar Cells

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Organic semiconductors have seen an ever increasing interest in recent years, thanks to easy iteration in their design process and a potential for decreased manufacturing costs when compared to traditional metalloid semiconductors. Organic solar cells in particular have received a large amount of attention thanks to unique properties such as mechanical flexibility, semi-transparency, and balance between cost and efficiency. There are a few notable high efficiency polymers (e.g., D18, PM6, and PTQ-10) which have demonstrated efficiencies over 20%. One stark comparison is the cost difference between those materials, with PTQ-10 having lower cost and lower synthetic complexity. A notable feature of PTQ-10 is the incorporation of fluorine as a strong electron-withdrawing group, which allows these solar cells to achieve higher voltages and quick charge transport. Inspired by recent literature into chlorinated polymers, we explore the impact of replacing the fluorines found in PTQ-10 with chlorine atoms. In comparison between chlorine and fluorine, this approach has the potential to help to reduce costs, create safer synthetic paths, improve physical and thermal stability, and increase solar efficiency. Herein, we will update on the synthetic progress towards low-cost chlorinated polymers.

Computational Sentiment Analysis of Internal Union Reform Communications: Mapping Ideological Fragmentation within the UAWD Caucus

Leviticus Lintag

Mentored by: Abraham Walker

Fayetteville State University

Reform movements often become fractured once gaining institutional power. This research explores how the dynamics of a labor movement shift when a grassroots group gains leverage and ultimately falls apart. Using a corpus of 23,905 WhatsApp messages from the 'Unite All Workers for Democracy' (UAWD) caucus (2022–2025), I analyze the relationship between institutional success, internal conflict, and communicative tone. While traditional sentiment analysis often assumes that organizational decline is preceded by a decline in average tone, these findings reveal a different trajectory. Quantitative analysis, validated through a multi-instrument framework, falsifies the hypothesis that sentiment decreases steadily as conflict rises. Instead, I find that while the group's mean sentiment remained stable, polarization increased monotonically across all periods, with negative sentiment and message intensity rising sharply during the final dissolution phase. This study demonstrates that organizational fragmentation is better captured by measuring widening dispersion rather than fluctuations in average emotional valence. By applying these methods to a critical case of union dissolution, this research highlights how communicative dispersion serves as an early indicator of institutional fragility, offering a unique methodological approach for the computational study of organizational decline.

Space Fashion: Developing Protocol and Detailed Analysis for The Next Generation Spacesuit Fabric Durability Against Lunar Highlands Dust Simulant

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Mentored by: Dr.Tandeka Boko

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Can we survive on the Moon? Yes, but we need the right tools. One essential survival tool is a spacesuit. Prior spacesuits experienced tears and required replacement even before launch. We aim to determine whether recently proposed spacesuit fabric layers can withstand the sharp, abrasive conditions of lunar regolith (moon soil) that can damage fabric and contaminate skin, airways, and instruments. Our tested fabrics are Mylar sheets, Ripstop, and Nylon Tricot. We use Lunar Highlands Dust Simulant (LHS-1D) to simulate lunar soil. LHS-1D exhibits extreme abrasiveness due to its angular morphology, high surface reactivity, and chemically active defect sites formed through micrometeoroid impacts and solar wind exposure. Its chemical and physical characteristics make it effective for experimental research. Using scanning electron microscopy (SEM), we evaluate fabric damage after each tumbling-cycle abrasion test to demonstrate and compare wear and tear among fabric samples. While mechanical abrasion testing has quantified macroscopic degradation in selected extravehicular activity (EVA) fabrics, the underlying chemical interactions that initiate filament weakening remain poorly understood. Identifying these mechanisms is essential for designing materials capable of resisting long-duration lunar surface exposure. The goal of this research is to develop a protocol to pass along to the next cohort of student researchers for refined data analysis utilizing the methods for testing spacesuit effectiveness against lunar dust and identifying possible alternatives to traditional fabrication methods for more protective spacesuits.

Investigation of Deformations in Crystalline Structures

Isaiah Little

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In this project, we investigate the fundamental mechanical behavior and deformation of metals under various mechanical conditions. When materials like copper experience stress, their ability to deform or maintain structural integrity relies heavily on the movement of microscopic line defects within the crystal lattice, known as dislocations. Thermal vibrations act as a background medium that interacts with these moving defects, exerting a temperature-dependent drag force that alters mechanical resistance and overall material response.Using molecular dynamics simulations in LAMMPS alongside custom Python post-processing tools, we model copper atoms to observe how different background thermal environments and energy dissipation mechanisms impact dislocation motion across a range of stress conditions. Ultimately, this work aims to uncover the core physical mechanisms required to bridge atomic-scale dynamics with real-world experimental observations, laying the foundation for designing stronger, more resilient materials for industrial and high-tech applications.

Visualizing the Biochemistry of Cell Division Using Fluorescent Cyclins in Living Yeast Cells

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Mentored by: Orlando Arguello-Miranda

North Carolina School of Science and Mathematics

The cell cycle is the process of cell growth and cell division. The cell cycle machinery is conserved across eukaryotes, and model organisms such as baker's yeast (Saccharomyces cerevisiae) are used to study cell division biochemistry. Cyclins are major regulatory proteins that drive the cell cycle. In this project, we explore the role of two yeast cyclins, Clb2 and Clb6, which are similar to human cyclins and are understudied in cell division under stress. This work also uses the transcription factor Tup1 as a marker for nuclear division. Tup1, Clb2, and Clb6 will be visualized using the fluorescent proteins mScarlet, mTFP1, and mNeonGreen. We created strains carrying Clb2 tagged with mScarlet, Clb6 tagged with mTFP1, and Tup1 tagged with mNeonGreen using PCR amplification of DNA sequences that fuse each target protein to a fluorophore. PCR-amplified sequences were transformed into yeast cells, and positive transformants were identified by replica plating and fluorescence microscopy. Clb2-mScarlet transformants had a strong nuclear signal during cell division, confirming Clb2 tagging, whereas Clb6 signals were very dim, suggesting that Clb2 levels are significantly higher than Clb6 levels. All cells showed a bright Tup1-mNeonGreen nuclear signal, validating our nuclear measurements. This project also improved a microdissection protocol, speeding up yeast spore dissection. Future work will build a full catalog of fluorescent cyclins in yeast cells, supporting cell cycle research in cancer, reproductive, and stem cell biology.

Maximizing Graph Order with Fixed Matching Number

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Mentored by: Reed Hubbard

North Carolina School of Science and Mathematics

A matching on a graph is a set of edges where no two edges share a vertex, and a maximum matching is the largest possible matching. We determine the maximum number of vertices in a graph with a given maximum matching size, and the condition that no two vertices may have the same set of neighbors. Previous work in matching theory seeks to determine the maximum matching on a given graph, while this problem reverses that perspective. We build from a matching of size t, considering how additional vertices can be connected without increasing the size of the maximum matching or repeating sets of neighbors. Using K3 structures, we present an elementary construction with 3t + 1 vertices, where t is the size of the maximum matching. Our second construction utilizes all possible subsets for a set of core vertices. For each subset, we construct a new vertex whose neighbors are that subset, ensuring that no two vertices share the same set of neighbors. This construction produces 2t + t vertices, growing exponentially with the size of the maximum matching. We prove that both constructions are optimal in their respective cases and that no combination of the two would create more vertices, giving our final result of max(3t + 1, 2t + t) for the maximum number of vertices.

Mixed silane treatment of silicon wafers leads to different water contact angle measurements towards the preparation of conjugated polymer brush films

Alyssa Lovallo

Mentored by: Pamela Lundin

High Point University

Conjugated polymer brush (CPB) films offer improved mechanical properties compared to spun-cast films due the covalent bond between the chain and the surface. They also adopt conformations not seen in spun-cast polymers and have different opto-electrical properties as a result, thus making them intriguing materials to study for novel electronic applications. However, the best catalyst for film thickness is also prone to deactivation due to proximity effects between neighboring initiator sites. We have explored whether diluting the surface concentration of the active, polymer-initiating chains from (3-aminopropyl)triethoxysilane (APTES) surface treatment with inactive octyltrichlorosilane (OTS) might can prevent these proximity effects. Silicon wafers with a 100-nm silicon oxide layer were cleaned by sonication and plasma treatment, immersed in an APTES solution for 5, 10, or 15 minutes, then soaked with OTS for 24 hours to form a mixed monolayer. Water contact angle (WCA), a rapid proxy for surface composition, was used to compare treatments. Wafers exposed to APTES for 5 minutes remained hydrophobic (~103°), whereas 10- and 15-minute exposures decreased the angle to ~72°, consistent with greater amine incorporation at longer times. The best interval was then repeated and the amine sites were coupled to 4-bromobenzoic acid using EDC/DMAP chemistry, preparing the surfaces for polymer growth in a nitrogen glovebox. Tuning the APTES-to-OTS ratio offers a simple route to control initiator density and, ultimately, grow thicker, more uniform CPB films.

Soul Food: The Origins, Impact, and Health Disparities Amongst African Americans

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Mentored by: Colleen Hammelman

University of North Carolina at Charlotte

Though soul food is a popular cuisine within the African diaspora, there is much more to it than meets the eye. In this literature review, we explore soul food's origins in slavery, its impact on African American culture and entertainment, and its potential health risks for African Americans. To explore these topics, we reviewed research from scholars in history, culture, and health to guide our search, then synthesized those findings into our literature review. Soul food's history stems from the hardship of enslaved Africans whose drive to live was filled with hope for a better tomorrow. Through the food they were given and prepared, they blended their African traditions to keep their culture alive, and to this day, the ingredients they used and the methods of cooking they had are still used. Soul food has transformed from scraps into something that brings people together and offers African Americans a piece of their history that can stay with them for generations. One negative effect of soul food is the harmful ingredients used in the cooking, which can lead to several health problems. Overall, this research provides a better understanding of soul food by recognizing its cultural significance, understanding its past, and being aware of its health effects.

Magnesium-Doped Nickel Spinel Ferrite Nanoparticles as Lead(II) Adsorbents for Drinking Water Remediation

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Mentored by: Tandy Grubbs

North Carolina School of Science and Mathematics

Although wastewater treatment methods have substantially improved over the last several decades, heavy metal water pollution persists as an environmental concern around many parts of the globe. In particular, the presence of lead (Pb^{2+}) in waterways is especially harmful because of its toxicity at low concentrations, causing damage to the nervous system, kidneys, and cardiovascular system. Common methods for removing lead, such as chemical precipitation, ion exchange, and reverse osmosis remain expensive and energy intensive. Chemical adsorption can provide a simpler and potentially lower-cost alternative for removing lead and other pollutants from contaminated water. In particular, nickel doped magnesium spinel ferrite microparticles ($Ni_xMg_{1-x}Fe_2O_4$) can act as an adsorbent for Pb^{2+} removal. Spinel ferrites (AB_2O_4) are classified as a soft ceramic superparamagnetic material with a crystal cubic lattice structure, with oxygen anions forming the face-centered cubic lattice and metal cations occupying the tetrahedral (A) sites and octahedral (B) sites. Through its charged hydroxyl groups, spinel ferrites can adsorb Pb^{2+} in a process called cationic adsorption. This project explores the effect of doping and the ratio of nickel to magnesium in synthesized spinel ferrite particles to optimize adsorption. Lead concentration will be determined through a dithizone- based UV/Visible spectroscopy at ~520 nm. If successful, this work will confirm the extent to which of Pb^{2+} $Ni_xMg_{1-x}Fe_2O_4$ can adsorb and will provide a practical alternative for Pb^{2+} adsorption.

Creativity of Public Music Performance in Charlotte

Michael Lusardi

Mentored by: Cindy Gilson

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Charlotte is a city containing public spaces, and music can transform these ordinary spaces into places of expression and community interaction. Literature indicates that musicians use public space to make performances accessible, create opportunities for audiences and musicians to interact, and turn public spaces into cultural and creative environments. This project is important because understanding how musicians creatively utilize public spaces demonstrates how music contributes to Charlotte's cultural life while encouraging community interaction. These ideas led me to the question, "How do musicians use public spaces creatively for musical performances?". To answer my inquiry question, I explored research reports on street performing in cities around the world, examined videos and articles showing how public spaces were used creatively in performance, and researched the cultural and social values of public performance. To observe creativity in the real-world, I will attend a public music event in Charlotte and observe street performers. I will pay particular attention to how performers use the space and how they interact with the audience. This project is still in progress; however, I anticipate that musicians use public spaces creatively by adapting their performance to the environment, interacting with the participating audience members, and using the space itself as part of the experience. In conclusion, this project will help demonstrate how music contributes to the development of Charlotte's public spaces and community culture. The findings may also help event organizers and musicians in their understanding of how public spaces can provide creative performance opportunities and meaningful audience interactions.

Development and Optimization of a Topical Botanical Oil Incorporating Chelidonium majus and Juglans nigra for Podiatric Antifungal Applications

May Mabrouk

Mentored by: Margaret Kocherga

University of North Carolina at Charlotte

Superficial fungal infections of the skin and nails of the feet are prevalent clinical conditions characterized by high persistence and frequent recurrence rates, which are frequently reported in clinical literature to reach up to 50% (Tosti & Elewski, 2016). Consequently, botanical essential oils and lipid carriers rich in naturally derived bioactive compounds with antimicrobial and antifungal activity offer a promising path for alternative topical formulations. This study focuses on the methodical development of a lipophilic topical formulation for podiatric antifungal applications. Incorporating a blend of active botanical ingredients including Celandine (Chelidonium majus) and green black walnut (Juglans nigra), the preparation contains naturally occurring bioactive compounds such as isoquinoline alkaloids and naphthoquinones that exhibit documented antimicrobial and antifungal properties (Romanu et al., 2025). This presentation describes the formulation and optimization of an oil-based topical preparation containing celandine and green black walnut as primary active components. More specifically, we prepared and compared a series of formulations with varying relative concentrations to determine an optimal combination for topical use. We developed the formulations in collaboration with a professional foot-care practice and podiatrist, allowing them to be evaluated in a practice-based setting and optimized based on observations of how treated areas responded. Comparing the different formulations identified a preferred ratio based on topical performance and observed response. We will present the optimized formulation, observations from practice-based evaluation, and considerations for future quantitative antifungal and microbiological studies.

Determination of the Minimum Inhibitory Concentration of Crude Violacein Extract from Janthinobacterium lividum Against Staphylococcus aureus

Muntahin Hasan Maisha

Mentored by: Susan Gardner

Meredith College

Violacein is a natural water-insoluble indole-derived purple pigment produced by several bacterial species, which exhibits a broad spectrum of biological activities (anticancer, antioxidant, antifungal, antiviral), including strong inhibition of Gram-positive pathogens. Janthinobacterium lividum was previously isolated from an environmental water sample and confirmed via PCR amplification and Sanger sequencing. Preliminary screening showed violacein from both J. lividum and Chromobacterium violaceum produced measurable zones of inhibition against multiple Gram-positive and Gram-negative bacteria. In the present study, crude violacein was extracted from J. lividum, and UV-Vis analysis showed a maximum absorbance at approximately 576 nm, consistent with the presence of violacein. Different concentrations of the crude extract were tested against S. aureus in triplicate to determine the minimum inhibitory concentration (MIC). The extract inhibited S. aureus growth, with an MIC of 7.2 mg/mL, and no visible bacterial growth was observed at or above this concentration across three replicates. These findings support the antibacterial activity of crude violacein from the environmental J. lividum isolate against S. aureus and provide a foundation for further evaluation of its antimicrobial and biofilm-inhibitory properties.

Violacein: Evaluating the Antimicrobial Activity of Chromobacterium violaceum and Janthinobacterium lividum Against Gram-Positive and Gram-Negative Bacteria

Muntahin Hasan Maisha

Mentored by: Susan Gardner

Meredith College

Violacein, a tryptophan-derived purple pigment produced by several bacterial species, has gained attention for its antimicrobial potential. This study evaluated the antibacterial activity of violacein extracted from a laboratory strain (Chromobacterium violaceum) and a bacterium isolated from the Meredith College pond identified as Janthinobacterium lividum. Production conditions were optimized by comparing growth at 25 °C and 30 °C, with bacterial density measured via optical density and violacein quantified by absorbance at 570 nm. Optimal pigment production occurred at 30 °C for C. violaceum and 25 °C for J. lividum. Crude violacein pigment was extracted and antibacterial activity was assessed using disk diffusion assays against the following Gram-positive and Gram-negative bacteria: S. epidermidis, Pseudomonas aeruginosa, and Klebsiella pneumoniae. Across all tested organisms, J. lividum produced consistently larger zones of inhibition than C. violaceum. Both violacein extracts showed the strongest activity against Gram-positive Staphylococcus species, while Gram-negative pathogens exhibited reduced susceptibility.These findings highlight violacein's potential as a selective antimicrobial, particularly against Gram-positive bacteria. They also demonstrate the value of optimizing strain-specific production conditions and underscore the promise of environmental isolates as sources of novel antimicrobial compounds for future drug discovery.

Effects of Sphingosine-1-Phosphate on Osteoblast Differentiation in a Stroke-Mimicking Microenvironment

Catherine Malacane

Mentored by: Jacqueline Cole

North Carolina State University

Ischemic stroke impairs neurological and motor function, leading to significant bone loss and increased risk of falls and fractures. While bone deterioration post-stroke is commonly attributed to reduced mechanical loading from disuse, the cellular mechanisms contributing to stroke-related bone loss remain unclear. Using a mouse stroke model, we previously found dysregulation of associated metabolites in the sphingolipid pathway within the bone marrow microenvironment. This imbalance suggested impairment of normal vascular function and bone health. Sphingosine-1-phosphate (S1P), a sphingolipid metabolite, is known to support osteoblast survival, angiogenesis, and endothelial barrier integrity. When reduced, S1P promotes inflammation and disrupts vascular endothelial integrity, but its effects on osteoblast behavior remain uncertain. This study investigates stroke-mimicking S1P levels on cellular interactions between human osteoblasts and endothelial cells in a vascularized bone microdevice. Our results from alkaline phosphatase (ALP) assays will characterize the effects of S1P regulation on osteoblast differentiation. We hypothesize that reduced S1P levels mimicking ischemic stroke will reduce osteoblast ALP activity. By mimicking post-stroke conditions in vitro, this approach examines how metabolic disruption contributes to cellular dysfunction. Understanding how S1P downregulation affects osteoblast activity can help identify potential therapeutic targets to prevent stroke-related bone fragility and improve long-term recovery.

Using Pressure Sensitive Walkways to Detect Weight Distribution Changes Associated with Canine Osteoarthritis

Hansika Malapati

Mentored by: Morgan Ferrans

North Carolina School of Science and Mathematics

Osteoarthritis (OA) is a degenerative joint disease causing chronic pain, with clinical arthritis affecting an estimated 40% of dogs (Jacques, 2002). Most prior studies of OA have only examined one limb. Pressure-sensitive walkways (PSW) measure peak vertical force, the maximum force a paw exerts on the ground, and could reveal how OA in one or more limbs alters weight distribution. We hypothesized that OA shifts weight away from affected limbs and that a PSW can detect this shift. Client owned dogs from the NC Triangle area were screened using orthopedic exams, owner surveys, and radiographs. Dogs that passed screening completed PSW trials in a relaxed, square stance and while trotting, with multiple recordings per condition. Dogs with OA carried less weight on affected limbs and more on less-affected limbs to compensate. Using Youden's index, we identified a cutoff of +/- 19.8% deviation from normal weight distribution that best separated OA from healthy dogs. These findings suggest that PSW data can distinguish dogs with and without OA and could become a noninvasive diagnostic tool for clinical settings. Future work will compare PSW results with radiographic findings to further validate the method.

Longitudinal Clinical and Cognitive Trajectories Across Alzheimer's Disease Diagnostic Stages: Evidence from ADNI

Chand Mallangi

Mentored by: Zheming Gao

University of North Carolina at Charlotte

Clinical diagnosis of Alzheimer’s disease progression across cognitively normal, mild cognitive impairment, and Alzheimer’s dementia stages relies largely on categorical clinical judgment. Although these diagnostic categories are clinically meaningful, they may provide only a coarse representation of disease progression and can vary in timing across patients. Continuous clinical, cognitive, and demographic measures may therefore offer a more detailed view of how patient status changes before and during formal diagnostic transitions. This project uses longitudinal data from the Alzheimer’s Disease Neuroimaging Initiative (ADNI) to examine how the Clinical Dementia Rating Sum of Boxes (CDR-SB), cognitive assessment scores, demographic characteristics, and other clinical features evolve in relation to recorded diagnosis. Longitudinal trajectories of these features are compared across diagnostic groups and around transitions between cognitively normal, mild cognitive impairment, and Alzheimer’s dementia. Particular attention is given to identifying whether measurable changes in these features occur before a formal change in diagnosis, as well as to characterizing differences in progression patterns across patients and diagnostic stages. Preliminary findings indicate that increases in CDR-SB often precede formal diagnostic transitions from mild cognitive impairment to Alzheimer’s dementia. In addition, diagnosis-specific CDR-SB averages align closely with published clinical benchmarks, supporting the consistency of the observed patterns. By jointly examining CDR-SB and other longitudinal clinical and cognitive features, this study aims to provide a more detailed characterization of Alzheimer’s disease progression and the timing of diagnostic transitions.

Secondary proton buildup in space radiation shielding

Marshall Malone

Mentored by: Joel Dewitt

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Ionizing radiation exposure is the largest obstacle in space exploration, as it has detrimental health effects. The risks are not limited to humans either; radiation is also known to degrade electronics and optical instruments on satellites and space telescopes. Advances in radiation protection for long-term missions requires a deeper understanding of interactions between shielding materials and radiation. Since relativistic protons are the most abundant ion species in the galactic cosmic ray spectrum, they are the focus of this study. This work compared the shielding effectiveness of several standard and composite materials relevant to the design and development of future spacecraft or planetary surface habitats. A 1 GeV proton beam was used on shielding targets of varying composition with optically stimulated luminescence dosimeters behind them to measure absorbed dose. Absorbed dose was also scored from computer simulations using the radiation transport code FLUKA, which agreed well with the measurements obtained in the experiments. None of the shielding materials were able to reduce the absorbed dose below that measured by the unshielded (i.e., front) detector. Given the range of proton energies present in the galactic cosmic ray spectrum, these results are pertinent to health and human safety for future space exploration missions.

Tracking Athlete Progression: A Data-Driven Approach to Evaluating NCAA Track & Field Programs

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Mentored by: Jakub Michel

High Point University

When high school athletes and transfers look at college track and field programs, they usually rely on general reputation, word of mouth, or surface-level team rankings. There is currently no straightforward way to figure out which programs develop their athletes year over year versus those that just recruit already talented athletes. This project builds a data-driven model using TFRRS results to track individual athlete progression throughout their collegiate careers. By pulling career-long performance data for NCAA track athletes, we can map out how much athletes actually improve from their freshman to senior years. Aggregating these individual trajectories at the team level lets us compare coaching effectiveness across different programs and conferences. The main goal is to separate out programs that are genuinely great at coaching and development from those that simply buy success on the recruiting trail. Ultimately, this gives recruits, transfers, and coaches a much clearer, numbers-based way to measure the true value of a track program.

Investigating Edge AI Applications to Support Informed Construction Jobsite Decision-Making

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Mentored by: Gongfan Chen

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Generative AI can now describe images and answer questions about them, which could help workers understand jobsite conditions. However, these tools usually run on remote servers and need a reliable internet connection, which many rural and remote jobsites do not have. It remains unclear whether smaller models can run on compact devices and still support jobsite decisions. The central research question is: can a small vision language model, an AI that interprets images and text together, run locally on a low power computer and describe construction scenes, and what limits does it face in memory, speed, and reliability? We attempted deployment of the Moondream2 model on an NVIDIA Jetson Orin Nano with 8 GB of shared memory at three precision levels, and reported results for the official 4-bit quantized checkpoint, about 51 percent smaller on disk than the 16-bit version. It was evaluated on seven tasks across four static images and on 6 frames from 5 construction videos, captured by camera and analyzed one frame at a time. We measured file size, memory use, and response time. Static tasks took 5 to 19 seconds each, with peak whole-system memory of about 5.5 GB of 7.6 GB. The camera test reached about 6.0 GB and exposed repetitive generation that raised one response time to 78 seconds. Accuracy is not yet measured, so findings are preliminary. This work contributes an initial baseline for running compact vision language models without cloud processing, which matters where connectivity cannot be assumed.

Ally Financial Study

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Mentored by: Steven Cox

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As banking becomes more digital, many people are starting to use online banks instead of traditional banks with physical locations. Even though online banking is convenient, some customers may still have concerns that keep them from switching to a fully online bank. The purpose of this research is to find the main risks and concerns that may affect a customer's decision to use online banking. These concerns may include security, privacy, fraud, trust, and the lack of face-to-face customer service. Past research shows that people like the convenience and easy access of online banking, but many still worry about how safe their money and personal information are. This study will use focus groups and surveys to learn more about what customers think and feel about online banking. The expected results will show which concerns matter most and what fully digital banks, such as Ally Financial, can do to make customers feel more conformable. This research is important because online banks need to build trust, protect customer information, and make people feel secure if they want to attract and keep more customers.

Social Media Presence of Mid-Major Student Athletes: Building Trust and NIL Value

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Mentored by: Shaina Dabbs & Smaraki Mohanty

Elon University

The introduction of Name, Image, and Likeness (NIL) policies has transformed collegiate athletics. In today's social media landscape, student-athletes are using platforms like Instagram and TikTok to engage with fans and grow their personal brand. However, athletes at midmajor institutions often face disadvantages due to lower visibility compared to their counterparts. This research examines how social media content strategies influence audience trust, a critical antecedent of engagement and NIL value. Drawing on a pilot content analysis of NCAA Division I athletes and two experimental studies, we investigate the effects of content type (personal vs. professional) and platform-specific engagement cues (trending audio and hashtags) on perceived trustworthiness. Results reveal that personal content generates greater trust than professional content, particularly when engagement with trending audio or hashtags is low. Trending audio attenuates trust differences between content types, whereas hashtag effects are more limited. These findings extend athlete branding and NIL literature. The research offers actionable insights for athletes, athletic departments, and brands seeking to maximize NIL opportunities in increasingly competitive digital environments.

Functionalized copper phthalocyanine as a selective, non-noble metal catalyst for the electrochemical CO_2 reduction reaction

Nandana Marpadaga

Mentored by: Timothy Anglin

North Carolina School of Science and Mathematics

Increasing levels of atmospheric CO2 due to human consumption have generated a need for innovative carbon capture and utilization technologies. The electrochemical CO2 reduction reaction (ECO2RR) uses catalysts to break the C=O bonds, converting them into usable industrial fuels. The Cu-N center of phthalocyanine offers active sites favorable for electron transfer, and its structure works well to stabilize intermediates of the reaction, leading to high tunability of the ECO2RR. Substituent effects, specifically related to electron density, can also be observed as a result of modification of the catalyst, which can affect efficiency and product pathways. This project studies copper phthalocyanine (CuPc) as a catalyst that drives the ECO2RR to fuels such as CO and HCOO-. Five copper phthalocyanine derivatives were synthesized and evaluated as catalysts for the ECO2RR: CuPc, CuPc-NO2, CuPc-F16, CuPc-CH3, and CuPc-NH2. Electrochemical tests were performed on the catalysts to determine current output and current density, product formation, and efficiency over time. The effects of the ligands were analyzed individually, as well as collectively, through their characterization as either an electron-donating group or an electron-withdrawing group. Preliminary results reveal increased catalytic efficiency associated with electron-donating groups, possibly due to optimized chemical desorption barriers, and a uniform current output over time, suggesting long-term stability. This research has the potential to tune the ECO2RR to desired products through ligand modification and can be further applied to research into the formation of higher-order hydrocarbon and multicarbon products.

The Transformation of FEMA and how Communities Effect the way the Department Operates

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Mentored by: Marcelo Aranda

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The purpose of the project is to provide a history of the Federal Emergency Management Agency, and how it relates to current events, specifically Hurricane Helene that hit Morganton, NC in 2024. Information found through interviews (from adults with consent) in Morganton NC in both the North Carolina School of Science and Mathematics in addition to city council interviews, as well as documented cases completed by the United States and then used/recorded in and by other trustworthy sources. From my research, it is suspected that when Hurricane Katrina hit New Orleans in August of 2005, it not only changed the way the agency operated, but also led to an increase in size and efficiency in handling emergencies as well as policies regarding funding within the department. The results of the changes within FEMA and how they affect the lives of individuals that have experienced natural disasters are explored as well as compared to other responses from other countries. The dynamic between the community and its functions, assistance, and access to resources is also explored.

SuperVac: A Power Relocation System that Focuses on HVAC

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Mentored by: Carl Arrington

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Buildings often heat and cool unoccupied spaces, wasting energy. This project proposes using existing security cameras as anonymous occupancy sensors to guide HVAC operations. Our goal is to determine whether camera-based occupancy detection can reduce heating and cooling energy use in institutional and commercial buildings without installing new sensors. Occupancy-based HVAC control is a well-studied strategy, but it usually depends on dedicated sensors. Computer vision software would determine whether each zone is occupied, estimate how many people are present, and estimate crowd density to account for extra body heat. The main savings would come from reducing heating and cooling in completely unoccupied areas. Newer buildings with modern HVAC equipment, adequate zoning, and controls are the strongest candidates for implementation. Sending selected camera feeds to a central server would likely cost less than placing computing devices at each camera, and the results could feed directly into an existing building automation system. We expect this approach to reduce unnecessary energy use, offering a low-cost, privacy-conscious way to improve energy efficiency across many types of buildings.

Impact of Algorithm Optimization Techniques

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Mentored by: Luis Cueva Parra

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Code optimization is key to preserving time, computational resources, and human attention. Prime-sieve algorithms provide a well-understood computational workload for evaluating the impact of code optimization techniques on modern hardware. This study investigates how various optimizations, including static wheel factorization, aggressive compiler flags, and segmented processing influence the performance of two classical prime-generation algorithms: the Sieve of Eratosthenes and Euler's Linear Sieve. To improve the practicality of Euler's Linear Sieve, a hybrid data structure was designed to preserve its theoretical properties while reducing the performance penalties associated with traditional array and linked-list implementations. Performance was evaluated by measuring execution time across multiple input sizes over repeated trials. The experimental results demonstrate that implementation details and low-level optimization techniques substantially influence practical performance, often outweighing differences in theoretical time complexity. Findings also suggest that the extent of performance improvement is heavily implementation-dependent (for example, among the two Euler Sieve implementations developed, static wheel factorization manifested a ~98\% speedup for one, while only a ~51\% for the other) and that multiple optimization techniques can be combined to maximize improvements. These results highlight the importance of considering mathematical simplification, compiler assistance, and better workload organization, and illustrate how classical algorithms can serve as effective case studies for understanding practical code optimization.

Why Telling an LLM Who You Are Doesn't Help It Predict What You Think

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Language models are increasingly used to make subjective judgments, such as deciding whether a comment is offensive. People genuinely disagree about these judgments, and their disagreement is patterned by who they are. A now-common response is to tell the model who is judging, conditioning it on an annotator's demographic identity ("You are a Black person," "You are college-educated") so that it reproduces that group's perspective. This strategy rests on an assumption that has never been tested against the data it depends on, that people who share a demographic label also share their judgments. If they do not, no amount of demographic conditioning can help.We test the assumption and the strategy together, using 38,078 offensiveness ratings from 506 annotators [dataset]. The assumption does not hold. In 13 of 15 demographic groups, annotators who share a label agree with one another no more than randomly paired annotators do, and in several groups, they agree less [check].Our model experiments show that ceiling is real. Probing finds that demographic information is not usefully encoded in model representations. Fine-tuning on demographic prompts lowers accuracy. Identity-label prompting degrades predictions in 31 of 32 conditions across three models [models], including every condition at the largest scale. What does work is individual history: five examples of how a specific annotator rated previous items improve prediction roughly five times as much as their demographic labels [metric]. Demographic prompts are a weak proxy for individual perspective. Work that aims to represent human judgment faithfully should model what a person has actually said rather than the group they were assigned to.

Coyotes and Sea Turtles: Behavioral Patterns and Predation on Wassaw NWR

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Mentored by: Kristen Zemaitis

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Predation of sea turtle eggs and hatchlings is an important conservation topic worldwide. Anti-predator mesh screens are commonly used in the Southeast USA to protect eggs during incubation, but post-emergence predation events can be difficult to quantify. At our study site on Wassaw National Wildlife Refuge (NWR) (Georgia, USA), both native and non-native species pose threats to loggerhead sea turtle (Caretta caretta) hatchlings as they make their way to the ocean. Coyotes (Canis latrans) are a relatively new non-native species on the coast, and their strategies and behavior for predation of sea turtle hatchlings have not been fully investigated. To document predation events on Wassaw NWR, we monitored sea turtle nests between July and September of 2025 and 2026. We monitored all nests on the beach from the time they reached 42 days of incubation to three days post-emergence to document visual signs of coyote activity (digging/scratching, tracks approaching/circling the nest, scat/urine on nest). For select nests, we also utilized camera traps to monitor coyote activity. We documented coyote activity at over one-third of sea turtle nests on Wassaw NWR throughout the hatching season. Our data reveal that while anti-predator screens are effective at protecting eggs during incubation, coyotes can dig at the top of the screen to predate hatchlings as they emerge from the nest. This data increases our understanding of coyote-sea turtle predation interactions and will assist with informing management practices and sea turtle population estimates.

Pharmacokinetics of Transdermal Buprenorphine Solution in Neonatal Rats

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Buprenorphine is a common opioid analgesic used to relieve pain in animals, usually administered orally or by injection every eight hours. Frequent handling and the invasive nature of repeated drug administration may cause additional distress in research animals. In 2022, a transdermal buprenorphine solution (TBS) was approved by the Food and Drug Administration (FDA) for 96-hour pain relief in cats. Its noninvasive, long-acting properties support investigation of its use in rodents. TBS has been evaluated in adult rats, where a single dose maintained therapeutic plasma concentrations for up to 72 hours. However, the safety and efficacy of TBS as an analgesic in neonatal rats was unknown. We investigated the pharmacokinetics of TBS in neonatal Long-Evans rats. We hypothesized that buprenorphine concentrations would remain at or above the therapeutic level for 72 hours following administration of a low dose (LD) or high dose (HD) of TBS, with no adverse clinical effects. Pups from 12 breeding pairs were randomly assigned to one of four groups: LD (5 mg/kg TBS), low ethanol control (LD-C), HD (10 mg/kg TBS), or high ethanol control (HD-C). Blood samples from pups were collected at 1, 4, 8, 24, 48, 72, and 96 hours post-administration. Blood samples from dams were collected at predetermined time points following the return of their litters after drug administration to assess inadvertent transfer via allogrooming. Clinical assessments indicated that pup activity was not dose dependent. Pups in all groups gained weight, although weight gain was slightly slower in the HD group. Pups showed no skin changes and maintained milk spots, suggesting unaffected maternal care. Therapeutic plasma buprenorphine concentrations were maintained in the LD and LD-C groups for up to 24 hours and for up to 48 hours in the HD and HD-C groups. Notably, pups in the untreated ethanol-control groups also reached therapeutic buprenorphine concentrations, indicating inadvertent drug exposure, potentially via direct contact and/or transmammary delivery. Dams reached therapeutic concentrations at 4 hours, further demonstrating inadvertent transfer following contact with treated pups. TBS may provide a safe alternative analgesic with therapeutic plasma concentrations maintained for up to 48 hours, depending on dose, potentially reducing animal handling and improving animal welfare. However, future pharmacodynamic studies are warranted to determine analgesic efficacy.

Patterns of Moth Species Richness across a Latitudinal Diversity Gradient

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Mentored by: Joshua Holbrook

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The Latitudinal Diversity Gradient (LDG) has played a critical role in explaining the pattern of species richness in a polar-to-equatorial direction. Species diversity is richest near the equator but declines closer to the poles or at elevations too high for primary activity. Among the species affected are Lepidoptera, an insect order consisting of moths and butterflies. However, insect populations, including Lepidoptera, have declined in recent years. For instance, moth richness has decreased in the Northern Hemisphere due to high human density and rigorous agriculture (Wagner 2021). For this project, I measured Lepidopteran richness between several tropical and temperate locales following that of the latitudinal gradient, while taking into consideration anthropogenic disturbances. Moth samples were collected using four white insect sheets with UV lights between the hours of dusk; and butterfly samples during daylight hours using bug nets. Other methods include using regression models, specimen pinning, and visual surveys. This project was conducted throughout the spring and summer of 2026.

Women in the Margins: A Case Study of Female Book Owners in the Rare Books Collection at Atkins Library

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Mentored by: Randi Beem

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This project aims to identify rare books owned by women through a close examination of their marginalia, or marks made in the margins of books. Examples of these markings include signatures, annotations, and gift inscriptions left within the pages of a book. Marginalia provides researchers with a benchmark of how a book was used and background information about the person who owned the text. Although they are historically underdocumented in library catalogues, women have been marking books to establish ownership and record personal thoughts for centuries, especially when formal means of book ownership or collection were unavailable to them. Women book owners and collectors were often overshadowed by their male counterparts, yet they left behind physical proof of their existence and intellectual engagement with the texts they read. Analysis of marginalia allows us to bypass formal methods of record-keeping and uncover the historical female voices which have traditionally been ignored by archives. By examining the marginalia left behind in rare books, we can see how women subverted traditional forms of book ownership and left their mark on a male-dominated intellectual and literary landscape. Women's marginalia proves that women actively read, owned, and engaged with texts, challenging assumptions about female literacy and book ownership in past centuries.

Plants vs. Plaques: Investigating Flavonoid Interference with Amyloid-Beta Aggregates in the Fight Against Alzheimer's Disease

Mac McConnell

Mentored by: Kathy Matera

Elon University

Alzheimer's Disease (AD) is the fifth leading cause of death in Americans aged 65 years or older; currently, around 6.9 million Americans in this age group are suffering from AD. Although there is no existing treatment for AD, recent research shows that a diet containing a high concentration of flavonoids can aid in alleviating symptoms of AD in both mice and humans. However, this research shows only that the flavonoids have an inhibitory effect on the symptoms of AD, not why this effect occurs. This research project will investigate the underlying mechanism of flavonoid-modulated inhibition of AD. To model a normal diet, flavonoids have been extracted from vegetables and analyzed using thin layer chromatography (TLC), ultraviolet-visible (UV-Vis) spectroscopy, and nuclear magnetic resonance (NMR) spectroscopy to determine the composition of the extracts. These flavonoid extracts will then be added to both unaggregated and aggregated samples of amyloid beta (Aβ) peptides, which are a major molecular component of AD. Analysis of resulting aggregate sizes using SDS-PAGE will ascertain the flavonoids' ability to break up or prevent aggregation of the peptides. Then, NMR spectroscopy and UV-Vis spectroscopy will be used to determine the underlying mechanism of each flavonoid's anti-aggregative properties. This research seeks to determine the molecular mechanism of how flavonoids can prevent or treat AD and has the potential for pharmaceutical development. The knowledge gained from this project can also be used to create or further public health initiatives on a local or global scale.

Same City, Different Food Access: Comparing Distance, Operating Hours, and Venue Diversity at N.C. A&T and UNC-G

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Mentored by: Shona Morgan

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College food environments can influence students' practical access to food through the number and types of venues available, their proximity to campus, and their hours of operation. This study examined whether food access differed between two neighboring universities in Greensboro, North Carolina: N.C. A&T State University and the University of North Carolina at Greensboro (UNCG). Food venues on and surrounding each campus were identified, classified by venue type and on- or off-campus location, and mapped using standardized campus anchor points. Walking times and posted operating hours were used to evaluate spatial and temporal accessibility. Results identified 60 venues at UNCG compared with 53 at N.C. A&T, representing 13% more venues. UNCG also had four times as many sit-down restaurants (24 vs. 6). Among off-campus venues, 49% near UNCG were within a 10-minute walk compared with 5% near N.C. A&T. At peak availability, 90% of UNCG venues and 81% of N.C. A&T venues were open on weekdays; Sunday availability decreased to 68% and 55%, respectively. These findings demonstrate that campuses located in the same city can have substantially different food environments when access is evaluated across venue diversity, proximity, and operating hours. The next phase will extend the analysis beyond geographic and temporal access by applying Nutrition Environment Measures Survey instruments to examine healthy food availability, facilitators and barriers to healthy eating, beverages, and pricing, providing a more comprehensive assessment of the campus food environment.

Machiavellianism in Modern Politics: How Self-Interest and Corruption is Reframed as Patriotism and Justice

Finley McLean

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This project examines classical Machiavellian political theory and applies it to modern-day American politics, specifically analyzing how public officials reframe self-interest, ambition, and corruption as civic virtue and patriotism. Through a cross-historical analysis of classical political theory alongside contemporary policy issues, Niccolò Machiavelli's foundational concepts of political philosophy, notably the discussion of virtù and fortuna, are essential to describe and navigate modern politicians' self-serving nature. Examples such as the STOCK Act and the strategic projection of religious leadership demonstrate the ability of public figures to obscure ethical compromises and advance financial self-interest. Political leaders leverage public perception, religious rhetoric, and socio-economic movements to gain authority and bypass the need for ethical accountability. The research investigates classical moral leadership in the pursuit of freedom and a prosperous domestic front, evaluating its transformation into modern technocratic expertise, used primarily to maximize self-interest. The methodology used involves qualitative textual analysis and comparative case studies of modern policy mechanisms, including legislative oversight, rhetorical strategies, and constituent engagement. The findings suggest that political actors have successfully navigated systemic conflict by projecting moral superiority, while normalizing ethical compromises within democratic governance. This research contributes to political theorization of public ethics by demonstrating how these early strategies geared toward political survival remain embedded in modern American politics. Ultimately, understanding Machiavellian political theory clarifies modern structural incentives which shape legislative integrity, and offers insights into voter behavior, civic trust, and how constituents hold political leaders accountable.

Assembling Tick Mitochondrial Genomes from Somalia & The Gambia

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Mentored by: Rafael Felipe Da Costa Vieira

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Ticks are blood-feeding ectoparasites and major vectors of disease. The genus Hyalomma, relevant to our samples, is known to carry Crimean-Congo hemorrhagic fever virus (CCHFV), West Nile virus, and Coxiella burnetii (Q fever). Identifying tick species present in a region and the pathogens they carry is critical for public health. Our primary research question was: Can complete tick mitochondrial genomes be assembled from Illumina whole-genome sequencing data? Raw paired-end Illumina reads from two samples were assessed using FastQC, then processed through GetOrganelle for mitochondrial genome assembly. Contigs were identified using BLASTn against the NCBI nucleotide database. GetOrganelle recovered three partial contigs from S1, totaling approximately 2,497 base pairs, roughly 16% of the expected 14,000 to 16,000 bp mitogenome. Two contigs matched Hyalomma dromedarii (E-value = 0.0), while one was flagged as human contamination. S2 did not yield an assembly due to insufficient sequencing depth. Although a complete mitogenome was not recovered, these findings confirm that Illumina-based pipelines can recover tick mitochondrial sequence from field samples, and highlight the need for deeper sequencing and expanded regional reference databases to support disease surveillance in underrepresented regions.

From Social Media to the Ballot Box: Exploring the Determinants of Gen Z Voting Behavior

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Mentored by: Han Lheem

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Generation Z is emerging as an influential voting bloc in the United States, yet the factors shaping its electoral participation remain insufficiently understood. As the first generation to mature in a digital environment, Generation Z experiences political socialization through traditional influences, such as family, and contemporary influences, including social media. This study examined whether political interest, social media influence, family political discussion, and trust in government institutions predict voting behavior among Generation Z.Guided by Political Socialization Theory and the Civic Voluntarism Model, this study employed a quantitative, cross-sectional survey design. Data were collected from 91 Generation Z participants ages 18–27 using a questionnaire consisting of Likert-scale measures of political interest, social media influence, family political discussion, trust in government institutions, and voting behavior. Data were analyzed using descriptive statistics, Pearson correlation analysis, and multiple linear regression.Results indicated that political interest and social media influence were significant positive predictors of voting behavior. Political interest was the strongest predictor, suggesting that greater political interest was associated with greater electoral participation. Social media influence demonstrated a significant positive relationship with voting behavior, indicating that digital platforms may contribute to civic engagement among Generation Z. Family political discussion and trust in government institutions did not significantly predict voting behavior after controlling for the other variables. The regression model explained 26.3% of the variance in voting behavior. These findings highlight the importance of political interest and digital engagement in understanding Generation Z voting behavior and extend theories of political socialization and civic participation.

Determining the Rolling Resistance Coefficient of the Spherical Sailing Omnidirectional Rover (SSailOR) Prototype via Image Processing Integrated with Rolling Dynamics

Heidi Mcneill

Mentored by: Aditya Varanwal

North Carolina School of Science and Mathematics

Autonomous rovers are vital for planetary exploration, allowing humanity to map extreme environments. However, traditional rovers are constrained by the limited lifespans of conventional power sources. Utilizing local environmental forces, such as wind, offers a sustainable alternative for long-term operational longevity. While prevailing wind directions restrict existing wind-powered rovers or lack self-righting capabilities, the Spherical Sailing Omnidirectional Rover (SSailOR) uses controlled rigid sails for targeted omnidirectional mobility, including upwind motion. Achieving true multidirectional mobility requires accurately quantifying the coefficient of rolling resistance (Crr) to determine under what conditions the rover can move. To identify the Crr value, a Python-based image-processing code integrated with rolling dynamics was developed and validated using two aluminum cylinders with known Crr values. The same image-processing code was used with SSailOR's traction hoop to establish the rolling resistance coefficient. Testing was conducted for different parameters using a test matrix varying initial release positions, ramp lengths, and incline angles. The tracking code calculated the prototype's acceleration to solve a dynamic equation, factoring in a precisely calculated moment of inertia, to output specific Crr values for each trial. By repeating this process across all scenarios, individual Crr values were compiled into the experimental matrix to determine an accurate Crr value for the traction hoop. The values from all test configurations averaged between 0.005 and 0.008. Such a low Crr value validates the rover's mechanical feasibility, ensuring that a wind-driven architecture like SSailOR can reliably achieve long-term mobility in extreme planetary environments without conventional power constraints.

How has the Light rail innovated creatively public transportation in Charlotte?

Bryce Mcpherson

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

Public transportation plays a key role in allowing us to navigate the city of Charlotte efficiently, and finding innovative ways to navigate the city allows for a better commute. The literature indicates that expanding the light rail will be beneficial to the city of Charlotte; a better, more extensive light rail will reduce traffic in the city, allow for more access, and bring in money to the city. This project is important because it justifies expanding the light rail system in Charlotte, which has the benefits of reducing Carbon emissions and expanding access to the transit network. How has Charlotte's light rail creatively approached public transportation, and how can it improve public transit? To answer my inquiry question, I will examine research conducted on the light rail to find the benefits of the light rail in Charlotte and how it is an innovation in public transit in the city and the surrounding area. To observe creativity in the real world, I will examine the light rail and see why it is set up the way it is. This project is still in progress; however, I anticipate that the answer to my question will likely be that expanding the light rail network and continuing to innovate upon the light rail. In conclusion, this project's results will help make a case to the Metropolitan Public Transit Authority in Charlotte to expand the light rail.

Analysis of a Microwave Plasma on the Basis of Varied EMF Wave Interactions

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Mentored by: Michael Falvo

North Carolina School of Science and Mathematics

Plasmas are an extremely useful and interesting tool that are used in many fields of physics. However, in order to get to this useful state, the plasma requires a significant amount of energy. A common method of delivering this energy is through the use of electromagnetic waves. When these waves make contact with the plasma there are two different methods by which they can interact with the particles within the plasma. The first is that they can simply collide with and be absorbed by the atoms within the plasma. The second possible interaction, known as cyclotron resonance, can occur if the charged particles within the plasma are in a magnetic field. This magnetic field causes the charged particle to oscillate in a pattern known as a cyclotron allowing for the possibility of resonance with the frequencies of the emf waves. While this idea of resonance is used extensively in fusion applications, it is far less common in plasmas more commonly used by labs. In order to study its effectiveness at these scales, I am using a microwave as a source of emf waves and a pencil lead to concentrate the microwaves and spark a plasma. Through this project, I will show that when this type of plasma is magnetized and cyclotron heating becomes the dominant form of plasma heating, the ability of the plasma to maintain its energy will rise along with its temperature.

Evaluating how substrate type influences eastern oyster recruitment and persistence along estuarine shorelines

Scarlett Melgar-Garcia

Mentored by: Rachel Gittman

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Living shorelines are increasingly used as nature-based alternatives to hardened shoreline stabilization because they can reduce erosion while providing habitat for estuarine organisms. Eastern oysters (Crassostrea virginica) are important to these systems because oyster reefs provide habitat, stabilize sediments, and improve water quality. However, living shoreline structures vary in substrate material and design, and relatively little is known about whether novel structure types support similar oyster recruitment and persistence. This study evaluates oyster densities on three living shoreline substrates, Oyster Catcher® (OC), QuickReef® (QR), and Natrx Exoforms™ (NX) which were deployed in winter 2024 at the Theodore Roosevelt Natural Area in Pine Knoll Shores, North Carolina. Oyster density data collected in September 2026 are used to evaluate differences associated with substrate type, depth, orientation, and design. Oysters are sampled using quadrats at multiple locations among the living shoreline structures, and counts are standardized to density per square meter. We hypothesized oyster densities to be similar among substrate surfaces when depth and orientation were comparable, while structural features such as holes, crevices, and gaps may support higher oyster densities. Oyster densities are also expected to be highest at intermediate depths within the oyster optimal growth zone and on seaward-facing substrates. Understanding these relationships can inform future living shoreline design and coastal restoration while contributing to research on oyster habitat and shoreline resilience in coastal North Carolina.

College Student Engagement and Perceptions of AI Use in the Classroom

Harper Melnick, Sofia Blodgett

Mentored by: Kirsten Li-Barber

High Point University

This pilot study examines how college students perceive and use artificial intelligence (AI) in educational settings. Previous studies (e.g.,Bu et al., 2026; Gu et al., 2026; He et al., 2026) have primarily focused on topics related to AI literacy, dependency, and effects on students' thinking and learning. The current study extends the existing literature by examining why and how students utilize AI tools to aid in their education, and the relationship between attitudes towards AI and AI utilization. Participants included 130 undergraduate research students drawn (M = 19.32 years, SD = 1.21). The majority of the participants were female (N = 101). Pearson correlations showed positive correlations between AI usage and cognition/learning (r =.565). Attitudes and beliefs were also positively related to AI use in classes where students cared about the material being learned (r = .37, p = .xxx) and their grade (r = .33, p = .001). There was a significant positive correlation between cognition/learning and attitudes/beliefs (r = .57, p = .001). No significant relationship was found between attitude/beliefs and concerns about how future professional AI use would be viewed by peers (r = -.06, p = .51. These results represent an initial examination into the nuanced relationship students have with AI and how they believe it may facilitate their learning in college. Limitations and future directions will be discussed.

Visualizing Public Health: Building Interactive Dashboards to Strengthen the North Carolina Public Health Workforce

Zoe Migioni, Nkazimulo Gumede

Mentored by: Sabina Otienoburu

Johnson C. Smith University

North Carolina public health agencies face gaps in data science capacity, particularly in data visualization. A 2024 mixed-methods workforce assessment identified differences between local and state health department employees in data collection, cleaning, statistical analysis, and visualization skills. This project aimed to strengthen practical data visualization skills among local health department and North Carolina Division of Public Health professionals. The project team developed a step-by-step Tableau Public guide and delivered three hands-on workshops, including one in-person and two virtual sessions. Using CDC/NCHS infectious disease mortality data, participants imported and reshaped data, analyzed mortality trends by disease and age group, mapped state mortality rates, and combined the visualizations into an interactive dashboard. Participants completed dashboards containing filters for disease, year, and jurisdiction. The completed dashboards demonstrated that a guided, short-format workshop could help participants with limited data visualization experience produce usable public health visualizations. The step-by-step guide also provided participants with a resource for continued practice after the workshops. The completed workshop products support the feasibility of this training approach and provide a model for strengthening data visualization capacity within the public health workforce. Future work will assess learning outcomes, develop asynchronous materials, and adapt the curriculum as North Carolina public health agencies transition from Tableau to Power BI.

Mechanistic Origins of Biopolymer Gelation Dynamics and Network Topology

Dylan Miller

Mentored by: Nathan Hudson

East Carolina University

In a blood clot, blood is physically restricted by a scaffold of fibrin fibers. These fibers are formed by the conversion of fibrinogen to fibrin through the action of the enzyme thrombin. Fibrin then polymerizes longitudinally and laterally, finally forming mature fibers. These mature fibers are connected in a dense, 3-dimensional biopolymer gel. Previous research has demonstrated variations in the structure of this gel under various hemostatic conditions and disease states, but has been unable to resolve the process by which these gels form. Here, we use light sheet microscopy to resolve fibrin polymerization in real time and in 3-dimensions. Fibers are extracted with a hand trained AI segmentation model and tracked with a custom built suite of tracking algorithms specifically tailored to fibrin. We use these tools to measure fiber growth and the dynamics of fibers throughout polymerization. We further measure, for the first time in any native biopolymer gel, the structural definition of gelation as the spanning of a connected cluster of polymers. We compare these measurements to dynamic, fiber oriented simulations to validate our analysis tools and interrogate parameters involved in gel formation.

Investigating BAPTA-Mediated Ca^{2+} Inhibition Effects on Metformin-Dependent AMPK Rescue in Regeneration in Dugesia japonica

Mishka Mittal

Mentored by: Heather Mallory

North Carolina School of Science and Mathematics

Acute lung injury (ALI) and acute respiratory disease syndrome (ARDS) are rising in the United States, with over 75,000 deaths annually and a fatality rate of 40–60%. A significant contributor is pulmonary edema, caused by a failed regenerative response in the alveolar epithelium, where the transition of alveolar type 2 (AT2) cells into alveolar type 1 (AT1) cells is disrupted when inflammation overrides the regenerative state, leaving the barrier stalled and non-functional. Current strategies either alleviate symptoms or target cyclic adenosine monophosphate (cAMP) signaling, which fails in clinical trials due to timing and delivery. To model this stalled state efficiently, this study uses the planarian flatworm Dugesia japonica, whose epithelial regeneration relies on bioelectric signaling through membrane voltage and Ca^{2+} voltage-gated ion channels. Chelating Ca^{2+} with 50 μM BAPTA-AM for 2 hours prevented the planarian from establishing a proper wound-site voltage gradient, producing a confused, non-regenerative phenotype validated by phenotype imaging, Fura-8, and DiBAC4(3) fluorescence assays. This study now tests whether that locked state can be reopened through two mechanistically distinct routes: a biochemical route using metformin, an AMPK activator with established effects on alveolar epithelial cell survival that bypasses Ca^{2+} channels, and a biophysical route using an external electric field that restores the missing voltage gradient directly. Because these routes are non-redundant, they will also be tested in combination. This work establishes BAPTA-AM as a reagent for modeling non-functional regeneration and tests whether bioelectric therapies, established in human bone and wound healing, can reopen a chemically locked regenerative failure.

Losing Our Cool: Assessing Green Space Heat Mitigation and Public Health Vulnerability in North Carolina Urban and Suburban Counties

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Mentored by: Anindita Das

Lake Norman High School and East Mecklenburg

While planting green space is widely promoted to combat extreme heat, little research examines whether county-level green space actually reduces heat-related illnesses in North Carolina. We tested this relationship across all 22 urban and suburban counties in the state. Using 2023 National Land Cover Database data, we calculated total and public green space percentages for each county and compared them with 2023 HRI emergency department visit rates per 10,000 residents and median household income, using bootstrapping, Kendall's tau correlation tests, and a two-sample t-test. Suburban counties had significantly more green space than urban counties, by an estimated 6 to 16 percentage points, and the Piedmont, home to the state's largest metropolitan areas, had significantly less public green space than the rest of the state. Yet neither total nor public green space was correlated with HRI rates. Total green space instead correlated positively with median household income. These results suggest that the quantity of green space alone does not explain which counties bear the greatest heat burden, and that income, access to cooling, and the quality and placement of vegetation deserve closer attention. By testing a widely held assumption with statewide data, this study clarifies what green space-based heat mitigation must account for before it can be targeted where it is needed most.

TCF1 Represses Pou2af1 (OCA-B) Expression in Jurkat T Cells: Implications for T Cell Gene Regulation

Cameron Mobley

Mentored by: Dean Tantin

North Carolina A&T State University

OCA-B, encoded by the gene Pou2af1, is a transcriptional cofactor that promotes $CD4^+$ T cell memory and plays an important role in autoimmunity and long-term tumor control. However, the regulation of Pou2af1 expression is not well understood. This study examined whether T cell factor 1 (TCF1), a transcription factor typically considered a repressor, regulates Pou2af1 through direct promoter binding. Bioinformatic analysis identified a frequent TCF1 binding site within the Pou2af1 regulatory region, leading to the construction of three luciferase reporter plasmids: a wild-type promoter, a single mutant, and a double mutant. These constructs were transfected into JurKat-RED T cells and analyzed across four independent experiments. While the initial experiment showed higher activity from the wild-type construct, the remaining experiments consistently demonstrated reduced promoter activity compared to the mutant constructs, with the double mutant producing the strongest signal. Overall, these findings support that TCF1 primarily acts as a transcriptional repressor of Pou2af1/OCA-B expression in T cells and suggest potential relevance to immune checkpoint inhibitor–associated immune dysregulation.

Search for Antimicrobial-Producing Bacteria in an NC Coastal Wetland

Parker Moffa, Hasan Ali

Mentored by: Leila Reyes-Ruiz

Campbell University

Wetlands are unique environments, hosting diverse populations of organisms and playing an important ecological role as a natural site for groundwater filtration and storage. Wetlands are also home to a robust population of bacteria and other microorganisms, many of which are unclassified and unstudied by microbiologists. We plan to use a coastal wetland as a site for soil sampling, isolate bacterial colonies from the soil, and test those colonies for antimicrobial production. Antibiotic discovery is an essential part of microbiological research given the current antibiotic resistance crisis our healthcare systems are experiencing. Unique and unstudied environments are perfect sites for the discovery of new antimicrobial compounds that can be further processed into antibiotic drugs. We hypothesize that wetlands, given the characteristics described above, hold great promise as bioprospecting sites for antimicrobial producers and we expect to isolate and characterize several promising bacterial colonies. During this project, soil samples from a coastal wetland were obtained, and bacterial colonies were isolated and screened for antimicrobial properties. There were found to be several isolates which inhibited the growth of the ESKAPE safe relatives, a group of non-pathogenic bacteria related to common pathogens. Currently, we are working on identifying promising antibiotic producers by sequencing the 16s rRNA gene and extracting the secondary metabolite responsible for the isolate's antimicrobial properties.

Comparative Analysis of Results Using Different Solvents

Su Mon

Mentored by: Carolyn Hoffman

Wake Technical Community College

Antibiotic resistance is a growing global health concern, posing significant public health challenges because disease-causing microorganisms develop resistance to antibiotics and there is a shortage of effective antibiotics. Since over two-thirds of antibiotics originate from soil bacteria or fungi, the research question is whether other soil bacteria could help to develop new antibiotics. First, soil samples were collected on campus, and the four most promising soil bacteria – SB15, SB18, CM17, and CM38, were isolated. Among the four isolates, SB15 has shown consistent positive results for visible, measurable zones of inhibition in Kirby-Bauer susceptibility tests against the five Gram-positive tester strains: Staphylococcus epidermidis, Micrococcus Luteus, Staphylococcus aureus, Staphylococcus saprophyticus, and Staphylococcus simulans. For Kirby-Bauer susceptibility tests, filter discs were soaked with 30 µL of SB15's organic matter, which was resuspended in 160 µL of chloroform instead of Ethyl Acetate. These filter discs were dried, placed on a lawn of each of the tester strains, and the plates were incubated at 35°C overnight. Comparing the plates of soaked Kirby-Bauer discs with different solvents, we found that the discs with chloroform resuspension resulted in larger, clearer zones of inhibition around the discs, thus proving that SB15 makes a bioactive compound that inhibits the growth of the five tester strains. This project helps in crowdsourcing the discovery of antibiotics from a variety of soil samples globally and providing a hands-on experience for STEM students.

Exploring Academic Self-Efficacy and Mentorship Participation Among Marginalized Students at HBCUs

Jessica Montanez-Fuentes

Mentored by: Michelle Bates

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Academic self-efficacy is an important factor in student success and persistence in higher education. This quantitative study examined the relationship between mentorship participation and academic self-efficacy among marginalized students attending a Historically Black College or University (HBCU). Participants completed a survey measuring mentorship participation and academic self-efficacy. Pearson correlation, simple linear regression, and an independent-samples t-test were used to analyze the data. Results indicated a statistically significant, moderate positive correlation between mentorship participation and academic self-efficacy ($r = .37$, $p = .012$). Simple linear regression further demonstrated that mentorship participation significantly predicted academic self-efficacy, accounting for approximately 13.3% of the variance ($R^2 = .133$, $F(1, 45) = 6.92$, $p = .012$). An independent-samples t-test revealed no statistically significant difference in academic self-efficacy between first-generation and non-first-generation students ($t(44) = 0.82$, $p = .417$). These findings suggest that mentorship participation is associated with higher levels of academic self-efficacy among students who attend HBCUs and emphasize the importance of mentorship programs in supporting student confidence and academic success

The Anatomy of an Apology

Lola Moore

Mentored by: Drew Perry

Elon University

The Anatomy of an Apology is an epistolary short story written as part of my research in Creative Writing. I am writing a series of interconnected short stories focused on the shift in American Identity around 9/11 through the use of a patchwork narrative. Each story within the collection is connected in some way, usually through the exploration of the same characters across different parts of their lives. The stories encapsulate the small and large changes in individual lives after 9/11 and how these changes have had rippling impacts. As we have just reached the 25th anniversary of 9/11, it is important to reflect on such a major event in American culture that has had such massive ramifications. It is also the perfect time to study the impacts of 9/11 as we have reached a moment in our country's politics and economics in which many Americans are asking: How did we get here? This piece is included in the collection and focuses on themes of addiction, identity, and love. The narrator grapples with the way she and the letter's recipient have changed since they met, and fights with her own emotions for what is best for them both.

Take a Breath:

Tais Moore

Mentored by: LaBarron Hill

North Carolina A&T State University

The practice of accepting current thoughts and being present in the moment is considered Mindfulness. The integration of mindfulness-based intervention into religious and spiritual practices has been proposed as a potentially useful addition to improve stress and health-related outcomes for African Americans. Although prior research acknowledges conceptual similarities between mindfulness, religious and spiritual practices, there has been little investigation into the overlap of these concepts. The current study investigated associations among mindfulness, religious coping, and spirituality in a sample of African American emerging adults (N = 258, Mean age =20.95, SD = 5.1 years, 67% female). Mindfulness was assessed using the 10-item version of CAMS-R; religious coping was assessed using the subscale of the COPE Inventory, and a single item evaluated participants' ratings of religiosity and spirituality. Results computed through Pearson correlations suggest that mindfulness shares small associations with religious coping ($r = .17$, $p = .02$), spirituality ($r = .23$, $p < .01$). Among men mindfulness was correlated with religious coping ($r = .27$, $p = .014$), religiosity ($r = .27$, $p = .014$) and spirituality ($r = .32$, $p < .01$), but was only significantly correlated with spirituality ($r = .19$, $p < .02$) among women. Future research should consider the impact of stress, and particularly whether underlying differences in stress exposure might account for gender differences in relations among mindfulness, religious, and spiritual coping.

From Discharge to Recovery: Barriers Faced by Individuals Experiencing Homelessness

Maurelle Moowad

Mentored by: Vania Bredy

University of North Carolina at Charlotte

Homelessness is a significant public health issue in the US and is associated with poor health outcomes and frequent hospital visits. Literature shows us that housing instability and lack of social support make it challenging for individuals experiencing homelessness to maintain a healthy lifestyle post-discharge from the hospital. However, less is known about the perspectives of individuals who are chronically homelessness and resources such as housing and social supports that can help them to avoid hospital readmission. This current study is intended to examine the experiences of individuals currently or formerly experiencing homelessness and hospitalization regarding their social supports and housing resources, as well as how these resources might help them not return back to the hospital. METHODS: Qualitative data will be gathered by means of one-on-one semi-structured interviews with 5-8 individuals currently or formerly experiencing homelessness and hospitalization in the Charlotte, North Carolina area. Interviews will be conducted in September and October and will be focused on the participants' experiences post-discharge, social support, challenges they are facing and possible factors that cause them to seek hospital care. RESULTS: Interviews with # participants revealed {challenges/resources identified by participants such as housing instability, transportation issues, access to healthcare, social supports}. CONCLUSION: Main finding of the study includes {major conclusion about participant experiences}.

Development of an Inexpensive Trehalose Quantification Assay for Characterizing Diet-Induced Hyperglycemia in a Drosophila melanogaster Model of Type 2 Diabetes

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North Carolina School of Science and Mathematics

Type 2 diabetes mellitus (T2DM), projected to affect 783 million adults by 2045, is characterized by insulin resistance and persistent hyperglycemia. Drosophila melanogaster is a valuable T2DM model because its insulin signaling pathway and metabolic organs are functionally conserved with mammals, and a high-sucrose diet (HSD) reliably induces hyperglycemia, measured as elevated hemolymph trehalose. However, trehalose quantification currently relies on costly enzymatic assays and commercial kits, limiting its use in resource-limited research and teaching laboratories. This study aims to develop and validate a low-cost spectrophotometric method for quantifying circulating trehalose in Drosophila. To date, control and high-sucrose diets have been prepared, and W1118 flies have been assigned to control and HSD groups, which are currently completing a ten-day feeding period. Following feeding, whole-body homogenate will be collected and heated under alkaline conditions to degrade reducing sugars, isolating trehalose based on its non-reducing property. The remaining trehalose will be quantified using the phenol–sulfuric acid assay, which produces a colored product measured at 490 nm against a trehalose standard curve. This protocol has been piloted in wild-type flies to optimize sample preparation and assay conditions. HSD-fed flies are expected to show significantly elevated circulating trehalose relative to controls, and the method is expected to show a linear response across a physiologically relevant range at a fraction of the per-sample cost of commercial kits. If validated, this approach will provide an accessible alternative for detecting diet-induced hyperglycemia in Drosophila research and teaching laboratories.

Computational Identification of RNA Thermometers in Fungi and Their Potential Role in Temperature Adaptation

Jayden Morales

Mentored by: Rebecca Guth-Metzler

Queens University of Charlotte

RNA thermometers are temperature-sensitive RNA structures that control gene expression by changing their shape in response to temperature shifts. In many organisms, these structures help regulate heat shock proteins and other genes involved in survival and virulence. Although previous research suggested that RNA thermometers may be absent in fungi, newer computational methods have created opportunities to investigate their presence. This project aims to identify potential RNA thermometers in fungal genomes and explore their possible role in temperature adaptation and human infections. The research will use computational approaches to analyze fungal genetic sequences, focusing on the regions where RNA thermometers are usually located, specifically, 5' untranslated regions. RNA sequence and structural analysis tools will be used to identify candidate RNA thermometers and predict their temperature-dependent structural changes. It is expected that this approach will identify potential RNA thermometers in some fungal species and provide insight into how temperature influences gene regulation. The current goal is to computationally scan all sequenced fungi for RNA thermometers, compare their predicted temperature responses, and investigate possible relationships between temperature adaptation and fungal virulence. Understanding the presence of RNA thermometers in fungi could help explain how certain fungi survive at human body temperature and potentially cause infections. This research may also identify RNA thermometers as potential targets for future antifungal treatments and contribute to a better understanding of fungal adaptation and pathogenicity.

Culture & Academic Self-Efficacy

Ennifer Moyei

Mentored by: Michael Matthews

University of North Carolina at Charlotte

Adolescents around the world struggle with burnout, insufficient sleep, and mental health issues within and outside school. There is extensive research of various reasons that may cause this statistic, yet there is a gap in understanding how culture and school structures may contribute. This paper explores how culture affects adolescents' development of self-efficacy, which is self belief/confidence, within academics and depressive symptoms. This literature integrates peer-reviewed articles from psychology, culture, and education to reveal the individualist and collectivist academic perspectives, the development of academic self-efficacy, the risk factors of self-efficacy, and the unique relationship between academic self-efficacy and depression. All of these themes converge showing how the culturally-influenced education frameworks that a student experiences in educational settings can affect their academic self-confidence. An adolescents' self-confidence can be affected positively or negatively by various parts of their academic culture. Depression may be a result of a students' negatively impacted self-efficacy, but it can also be the reason why a student may have a low self-efficacy. The overall contribution of this literature review is to bring awareness to students who may be battling with feelings of incompetence related to their academic performance to understand that their feelings may be due in part to the influence of their surrounding societal norms and culture.

Light-Assisted Drying for Cold-Chain-Free Pandemic Flu Vaccine

Griffin Moyers

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Vaccination against infectious disease is one of the most significant advances in modern medicine. However, most vaccines are thermally sensitive and lose potency unless kept refrigerated or frozen. This requirement creates a major hurdle during health emergencies. For example, as seen during the COVID-19 pandemic, relying on cold-chain storage limits our ability to rapidly deploy and stockpile vaccines for a global response. To address this, our study utilizes Light-Assisted Drying (LAD) to trap fragile vaccine antigens inside a protective sugar matrix for room-temperature storage. Near-infrared laser illumination drives rapid evaporation of water from a liquid formulation to create a sugar solid. Here, we applied LAD to a multicomponent recombinant vaccine targeting H5 and N1 antigens from Clade 2.3.4.4b avian influenza. Vaccine antigens were formulated with a 0.2 M trehalose buffer solution. Droplets (25 μL) on coverslips were illuminated with a near-infrared laser while sample temperature was monitored via thermal imaging. After drying, polarized light imaging confirmed that LAD produced an amorphous sugar matrix without damage or crystallization. Hemagglutination and neuraminidase functional assays confirmed that targeted antigens retained their activity after drying. These findings demonstrate that LAD is a promising tool to eliminate cold-chain dependence, enabling easier stockpiling and faster vaccine response during future pandemic threats.

Transferable Hotspot Ranking and a Universal Concentration Distribution for Microplastics in Freshwater Lake Sediments

Saicharan Mudium

Mentored by: Daniel Egger

North Carolina School of Science and Mathematics

Microplastic contamination of freshwater sediments is a growing environmental concern, but sampling remains sparse and costly. In addition, most existing sampling studies focus on microplastic distributions within a single lake, and different studies use different laboratory protocols, making measurements difficult to consolidate and compare. The primary goal of this project was to examine whether microplastic concentrations in lake sediments could be predicted across different lakes and laboratories using geospatial data. A novel dataset was assembled by pairing microplastic concentrations (MP/kg dw) from published Great Lakes studies and an independent Central Asian dataset with geospatial covariates such as elevation, land cover, population, and wastewater infrastructure. Multiple models were trained and evaluated using random cross-validation and more stringent validation schemes: leave-one-lake-out (LOLO) and leave-one-study-out validation. Models predicting absolute concentrations were accurate under random cross-validation but failed to generalize to unseen lakes under LOLO validation. In contrast, a pairwise-ratio model generalized across lakes to identify contamination hotspots, because taking ratios between sites in the same study cancels each laboratory's constant offset. It was found that within-lake concentrations were well-described by a log-normal distribution, as validated by the Akaike information criterion, Shapiro-Wilk normality tests, and quantile-quantile and Kolmogorov-Smirnov goodness-of-fit checks. After standardizing each lake, all lakes collapsed onto a common distribution, the only difference being their spread, which scaled with the base-10 logarithm of lake area. This universal distribution is significant because it can predict concentration statistics, such as the median and maximum, for unsampled lakes and reconstruct full profiles from few samples.

What Do We Actually Know About Trauma and Epigenetics in African Americans? Tracing Stress from Jim Crow to the Genome.

Teesha Mudliar

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North Carolina School of Science and Mathematics

Slavery and Jim Crow left Black communities with poverty, discrimination, and inadequate medical care, and the health disparities tied to that history, including premature mortality, persist today. Some researchers have asked whether this stress also left a biological imprint. The proposed mechanism is DNA methylation, an epigenetic process that alters gene activity without changing the DNA sequence. One of the most replicated findings is that early life stress changes methylation of NR3C1, the glucocorticoid receptor gene, which works with FKBP5 to regulate the stress response. The strongest evidence concerns a parent's trauma affecting their own children. Transmission across many generations is a far stronger claim, and it has not been demonstrated in African Americans. This project reads the scientific literature alongside historical materials from UNC's Wilson Library and select Duke archives. Epigenetic change may be one pathway from historical trauma to PTSD and chronic disease, though this remains unconfirmed, and medical mistrust rooted in past mistreatment may compound the effect. The aim is to separate what has been demonstrated from what has only been proposed.

Social Justice in the Judiciary System: Evaluating Psychological and Mental Wellness of Targeted Populations

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Social Justice can be advanced through the judiciary system. However, systemic biases lead to discrimination against minorities, potentially causing severe psychological distress or mental health disparities in impacted individuals. This research highlights how operations of the United States judiciary system lead to disproportional justice outcomes and affect individuals psychological and mental health evaluation and treatment. This study includes a critical literature review and data analysis to define and examine the legal institutions and policies that consistently, negatively impact minority groups through overrepresentation in criminal cases, incarceration rates, and attaching negative or violent perception to people of color and how those aspects lead to greater disparities in evaluation, diagnosis, and treatment of people with mental health problems. For overall sentencing, white defendants are more likely to receive pretrial diversion than Black or Latino defendants in similar legal situations, leading to more negative effects on psychological health. Additionally, historically used screening devices grant less positives for Black and Latino people, causing mental illnesses to go undetected in these specific jail populations. Ultimately, laws have created and perpetuated unequal conditions that have disproportionately impacted marginalized populations. These communities regularly face struggles that have resulted in having negative mindsets or outlooks, thus having to grapple with the extenuating mental circumstances as well. By assessing judicial policies and health data, this research highlights how such struggles can arise and provides recommendations to achieve more legal and psychological justice for affected persons.

Speaking for Species: The Power of Framing and Media Format in Shaping Anthropomorphism

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Mentored by: Kim Epting

Elon University

This project investigates effects of linguistic label frame and media format on anthropomorphic language referencing nonhuman animals. Anthropomorphism– the tendency to assign human characteristics to nonhumans– is often unconscious human behavior that has the potential to impact animal welfare, but literature is unclear on how linguistic framing specifically influences anthropomorphism. This mentored undergraduate research project begins to address this gap. In a 3 x 3 mixed factorial design, Prolific volunteers (N = 288) were randomly assigned to view 3 media forms (illustration, photograph, and video in counterbalanced order) of a binturong referred to as an "animal" (n = 95), "nonhuman" (n = 96), or "organism" (n = 97) and record their observations. Participants also completed the IDAQ (Individual Differences in Anthropomorphism, Waytz et al., 2010) to measure baseline anthropomorphic tendencies, where a maximum score of 150 indicates high anthropomorphism (0 = absence of this habit). Participants were diverse in anthropomorphic tendency (range = 0-121; M = 48.71), but stable across randomly assigned label frame groups ("animal" = 49.33, "organism" = 48.19, "nonhuman" = 48.64). Therefore, any differences in anthropomorphic language use among conditions are due to the manipulated variables. Analysis of participants' transcribed audio responses is underway to see if either linguistic label frame or media format individually or interactively impacted the amount of anthropomorphic language use. These findings may be applicable to conservation efforts, because the degree to which one perceives people, animals, and objects as humanlike influences how one treats them.

Seeing the Invisible Flame: UV Sensing for Hydrogen Flame Detection in Wind Tunnels

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Mentored by: Eduardo Leite de Moraes

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Hydrogen is a promising carbon-free fuel; however, its accumulation within enclosed spaces poses a serious combustion risk. In environments such as the BEFAST lab's wind tunnel, pure hydrogen-oxygen flames emit little visible light and their main product — water vapor — is indistinguishable from ambient humidity. Standard detectors rely on the carbon emissions from CH* and CO2, which our flame does not produce. Hydrogen-rated commercial units exist, but are cost-prohibitive and are difficult to integrate into a full array. Instead, our mixture's combustion creates the hydroxyl radical (OH*), releasing UV light that peaks at 306-310 nm during its transition from an excited to ground state. This project seeks to explore whether a low-cost AlGaN/GaN UV photodiode can serve as an accurate, carbon-independent method of detection for hydrogen flame combustion. The sensor's 220-320 nm response, combined with a 300 nm long-pass filter, narrows the effective detection range to approximately 300-320 nm — centered on peak OH* emissions. This project contains three main objectives: characterization of the photodiode sensor, development of an analysis program containing threshold and debouncing logic, and the full integration of these modules into a six-sensor array for BEFAST usage. Characterization is proposed to include the distance falloff, angular response, and response timing of the chosen sensor. A preliminary analysis program has been developed in Python and awaits bench validation. Data from all sensors will be combined through a sensor-fusion program, reducing false positives/negatives. If successful, this sensing array would allow for the detection of an otherwise invisible hydrogen flame.

Design and Synthesis of a Small-Molecule Modulator of West Nile Virus NS1′ Frameshift Pseudoknot to Enhance −1 Programmed Ribosomal Frameshifting for Antiviral Intervention

Lucas Murdoch

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

West Nile Virus, a prominent mosquito-borne flavivirus, causes severe neuroinvasive disease, including life-threatening encephalitis, acute flaccid myelitis, and meningitis, yet lacks approved small-molecule therapeutics that directly combat viral replication. Among patients who develop WNV-associated neuroinvasive disease, approximately 10% die, while survivors may experience chronic neurological impairment. The WNV NS1′ protein is expressed via -1 Programmed Ribosomal Frameshifting (PRF), a process where ribosomes are diverted into alternate reading frames to produce nonstandard proteins and regulate viral protein stoichiometry. It was hypothesized that binding a compatible small molecule to the NS1′ frameshift pseudoknot, the structure responsible for increasing the efficiency of PRF, will stabilize the pseudoknot and increase -1 PRF, resulting in altered viral polyprotein stoichiometry and impaired viral replication. An azastilbene-class candidate with hydrogen bonding dimethylamino and hydroxyl groups was computationally designed and synthesized through a Schiff-base condensation reaction. The ligand was designed to interact with the primary stem region of the NS1′ frameshift pseudoknot and stabilize the RNA structure. S. cerevisiae cultures were transformed with a custom dual-fluorescence reporter cassette to quantify the effect of Compound 5.1 on -1 PRF efficiency, while a zone-of-inhibition assay was used to assess growth inhibition.

Surrender, Purpose, and Sobriety - A Comparative Review of Faith-Based and Secular Substance Use Disorder Recovery

Makayla Myers

Mentored by: Ian Binns

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An estimated one in every seven Americans lives with Substance Use Disorder (SUD), roughly 15% of the U.S. population. Even though this disease grows increasingly common, research on it remains limited. This literature review analyzes key differences between faith-based and secular recovery options, acknowledges the gap in long-term sobriety rates between the two approaches, and advocates for answers that fuel better outcomes for all recovery journeys. The review examines this primary question: How do faith-based recovery programs influence long-term sobriety outcomes compared to secular programs? Peer-reviewed addiction research was synthesized from research published between 2010 and 2026. Secular recovery was found to emphasize self-control and self-management, while faith-based approaches emphasized community alongside faith, with the belief in surrendering SUD to a higher power. Whether faith-based or secular, spirituality was found to have the greatest impact on recovery rates across both programs. In one peer-reviewed study, individuals who experienced a spiritual awakening during recovery were found to have an 82% sobriety rate lasting one year, while only 55% of those who did not have a spiritual awakening had the same outcome. Secular recovery is a relatively new option without a consistent curriculum across facilities, while faith-based recovery is rooted in decades of experience and consistency. SUD does not discriminate, contributing to 600,000 deaths in the last six years. This review reveals just how under-researched addiction recovery is and calls for increased research and advocacy for a disease that has thrived in silence.

Video Games and Anime as Blueprints for Identity

Jeevan Nair

Mentored by: Balaka Basu

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For today's youth and young adults, interactive and serial media are cognitive simulations that shape the process of adult identity formation. This study investigates how the agency of active video game players and the serialized format of anime overcome cognitive barriers to contribute to the development of moral thinking, emotion control, and skills applicable to the real world for young adults. As a growing proportion of youth consume storytelling primarily through these mediums, examining them together reveals complementary developmental frameworks. Video games provide active agency and systemic decision-making, while serialized anime fosters sustained emotional investment and long-term character identification. Although popular public discourse tends to perceive gaming and anime as forms of escapism, and even as sources of behavioral aggression, academic research within media psychology and biopsychology shows that simulated stories trigger genuine autonomic responses and cognitive learning. This project integrates interdisciplinary literature from media studies, cognitive science, and human development into an undergraduate Honors College seminar that includes a six-week component focusing on experiential tracking, media comparisons, and simulations. Literature review findings indicate that video games enable individuals to practice their ethical agency in controlled systems, and serialized anime gives individuals opportunities to safely rehearse their emotions and develop their identity. Furthermore, the literature demonstrates that media's developmental benefits depend heavily on cognitive emotion regulation, differentiating constructive reflection from escapist overindulgence and predatory monetization. Ultimately, this research offers educators and students a framework for leveraging popular digital media as tools for identity development, critical literacy, and personal growth.

SALSA: SAST-Augmented LLM-Based Security Analysis

Rishi Nalam

Mentored by: Domenico Cotroneo

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As AI-generated code is increasingly deployed in production systems, verifying that it is free of vulnerabilities has become a critical concern. Static application security testing (SAST) tools are a well-established defense, valued for their determinism. However, their rules are intentionally generic, so they produce many false positives and miss complex vulnerabilities. Moreover, their accuracy varies widely across tools and weakness types: the same SAST tool may be precise on one CWE and blind on another, and each tool reports its alerts in isolation, with no notion of how reliable they are. Large Language Models (LLMs) can complement SAST, but used in isolation, they are non-deterministic and yield inconsistent assessments. Rather than replacing SAST, we propose SALSA (SAST-Augmented LLM-based Security Analysis), an agentic framework built on top of industry-grade SAST tools. SALSA operates at two levels. At the alert level, it decomposes triage into vulnerability-specific guidelines based on domain-expert best practices and gives the agent tools to explore the Code Property Graph (CPG) of the source code, validating each SAST alert step by step. At the pipeline level, an orchestration agent knows the tools in the pipeline, runs them, collects their alerts, and combines them using each tool's known precision and recall per CWE, producing a single detection report with a confidence level and the evidence behind it. SALSA integrates with existing pipelines without modifying their execution. By combining deterministic detection with CWE-aware aggregation and context-aware reasoning, SALSA reduces false positives while surfacing vulnerabilities that a single SAST tool alone misses.

Sparsity under Stress: Evaluating Capacity-Constrained Matching Efficiency in Sparse Networks

Hemanth Nallagatla

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Capacity-constrained maximum matching is central to resource-sharing systems such as middle-mile transportation, where locations must be paired without exceeding vehicle capacity. Existing theory often describes matching behavior in asymptotically large networks, but real systems are finite and sparsely connected. This study asks how network topology, connectivity, and demand distribution affect the matching efficiency lost when a complete network is replaced by a sparse one. A custom Python simulation framework evaluated K-Chain, Erdős- Rényi, and random d-Regular graphs across varying network sizes and degrees. In each trial, nodes were assigned stochastic residual demands, edges whose endpoint demands exceeded unit capacity were removed, and a maximum-cardinality matching was computed. Sparse-network performance was compared with an optimized complete-network benchmark using a matching-loss measure equal to twice the difference between the two matching sizes, representing additional unmatched nodes caused by limited connectivity. Experiments considered uniform demand on [0,1] and [0,0.9] as well as truncated exponential demand, with results averaged over repeated graph and demand realizations. Across the tested settings, matching loss decreased sharply as degree increased, but the rate depended strongly on topology and demand distribution. Random d-Regular networks generally produced the lowest loss, while Erdős- Rényi networks performed poorly at very low degrees but approached random-regular performance as connectivity increased. Finite simulations also closely tracked asymptotic predictions in several low-to-moderate degree regimes, with larger deviations at higher degrees. These results quantify when sparse network designs can retain strong matching performance without requiring complete connectivity.

Preserving the Moment of the Merger: A Queens Oral History Collection

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In September 2025, Queens University of Charlotte and Elon University announced their intent to merge. The following weeks and months brought changes and questions about the future of Queens. The project sought to preserve the experiences and feelings of the Queens community. Growing out of a Rhetoric of Public Memory course, this project employed oral history methodologies with the intention of compiling recordings and transcriptions of interviews for the Queens archives. We recruited participants from populations of Queens students, alumni, faculty, staff, and faculty emeriti, and conducted a total of 43 interviews lasting between 30 and 60 minutes. We crafted a list of questions that focused on the participants' relationships to Queens and their thoughts about the merger. After recording and transcribing these interviews, we identified some noteworthy themes. Participants' recollections of their times at Queens highlighted experiences of care within a diverse community. They also pointed to the significance of curricular and extracurricular opportunities. Regarding the merger, participants expressed feelings of concern and hope over the future identity of Queens and expanded opportunities for students, respectively. They also shared feelings of frustration over poor communication and hurt, stemming from not feeling heard by the university. In creating this collection for the Queens Archives, we were reminded of the importance of individual experiences in institutional histories. In a shifting higher education landscape, projects like this preserve the stories of individuals in communities experiencing structural changes and ensure these histories reflect a wide variety of voices and perspectives.

THE SUN AS A BUNSEN BURNER: MODELING FLUORESCENCE PROCESSES IN COMETARY COMAE

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Comets that pass extremely close to the Sun, known as sungrazers, get hot enough for refractory grains in the nucleus to vaporize, releasing free metal atoms into the coma that would otherwise stay locked in dust. Those atoms absorb sunlight and re-emit it through resonance fluorescence, so the resulting emission spectrum encodes both the composition of the comet and the physical conditions of the coma. We build a numerical model of this process: given a solar spectrum and a set of atomic energy levels and transition probabilities, we compute the equilibrium population of each energy level as a function of heliocentric distance and radial velocity, fit a Boltzmann distribution to derive an effective excitation temperature, and convert the populations into a synthetic emission spectrum (photons s^{-1} $atom^{-1}$). We apply the model to sodium (Na I), iron (Fe I), and nickel (Ni I), and show that resolving the solar spectrum at high resolution sharpens the temperature–radial-velocity relation, a signature of the Swings effect. We evaluate the model at the heliocentric distance and radial velocity of Preston's (1967) Ikeya–Seki spectrum ($r = 0.14$ au, $v_r = +110$ km s^{-1}) and compare simulated per-atom brightness against Preston's observed line intensities to estimate relative abundances, finding $N(Fe\ I)/N(Ni\ I) \approx 8.4$, broadly consistent with solar/chondritic values.

Stereoselective Modulation of the Autophagy-Lysosomal Pathway in Human Neuroblastoma Cells

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Alzheimer's disease (AD) is marked by the progressive accumulation of pathogenic proteins, including amyloid-β42 (Aβ42) and phosphorylated tau, which disrupt neuronal function and drive cognitive decline. The autophagy-lysosomal system is the main cellular pathway for degrading damaged and aggregated proteins, so enhancing this endogenous proteostatic machinery is a promising therapeutic strategy. Cathepsin B (CatB), a lysosomal cysteine protease within this pathway, cleaves Aβ42 into shorter, less amyloidogenic peptides, while also helping to clear tau tangles, thereby decreasing neuronal toxicity. A drug-development program has identified stereoselective small-molecule modulators designed to enhance lysosomal proteostasis, including CatB. Here we evaluated candidate compounds in human SH-SY5Y neuroblastoma cells by measuring CatB abundance and processing. Cells were treated for 24 h under serum-free conditions, lysed, and analyzed by Western blot using a CatB-specific antibody. We quantified mature CatB and a CatB fragment and compared relative band intensity across conditions. Compound identities and expected effects were masked during analysis to reduce bias. To define the stereochemical requirements for CatB enhancement, pyrrolidinyl derivatives were synthesized in homochiral form. Two derivatives showed modulatory activity exclusively with the R enantiomer. These results indicate that CatB modulation by this compound class is stereoselective, with activity residing in the R configuration. Future work will confirm these findings with enzymatic activity assays and lysosomal flux measurements, test whether the active enantiomers promote Aβ42 and tau clearance and extend the analysis to neuronal and in vivo AD models.

Supporting Active Living on Campus: Factors Influencing Cycling Among UNC Charlotte Students

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This project examines student perceptions of cycling at UNC Charlotte and explores how access to cycling may influence active living and well-being within a college community. Previous research has established the individual health benefits of physical activity, including improved sleep, memory, and overall well-being, less attention has been given to how active transportation contributes to community health and campus life. This project aims to better understand why students choose to bike, how accessible cycling is on- and off- campus, and the barriers and facilitators that influence cycling behavior. Using a community-engaged research approach, the project will combine quantitative and qualitative methods developed in collaboration with community partners. Quantitative data, collected with a survey questionnaire, and qualitative data, collected through brief interviews, will be collected from a convenience sample of students in high-traffic areas on UNC Charlotte's campus. The project will examine factors such as time, disability, bike storage, transportation needs, campus policies, perceived health benefits, and the practicality of using a bicycle for everyday travel. Expected findings include the identification of barriers that limit student cycling and opportunities to improve accessibility. Results will be shared with Trips for Kids and UNC Charlotte Student Wellness to inform future programming and campus initiatives. Ultimately, this research seeks to connect active transportation, community health, and campus engagement while providing a framework to expand accessible cycling opportunities on college campuses.

Breaking the Banking Barrier: Understanding What Drives Gen Z to Switch Banks

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Mentored by: Steven Cox

Queens University of Charlotte

This study investigates what keeps Gen Z consumers from switching banks and how Ally Bank can use this information to better attract this generation. The main research question focuses on which barriers have the greatest influence on Gen Z's willingness to switch banks, including the inconvenience of moving accounts and direct deposits, satisfaction with their current bank, trust, and other switching costs. Previous research suggests that customer loyalty, switching costs, trust, and digital convenience can all influence a consumer's decision to stay with or leave a bank. However, fewer studies focus specifically on how these factors affect Gen Z, a generation that is beginning to make more independent financial decisions. This study will use a survey of Gen Z consumers to measure the importance of different switching barriers, along with focus groups to better understand the reasons behind their attitudes and decisions. The research is expected to identify the factors that have the strongest impact on Gen Z's willingness to switch banks. These findings can help Ally Bank develop better offers, marketing messages, and switching experiences that reduce barriers and make the bank more appealing to Gen Z consumers.

Risk Avoidance in Digital Banking

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As banking becomes more digital, many people are starting to use online banks instead of traditional banks with physical locations. Even though online banking is convenient, some customers may still have concerns that keep them from switching to a fully online bank. The purpose of this research is to find the main risks and concerns that may affect a customer's decision to use online banking. These concerns may include security, privacy, fraud, trust, and the lack of face-to-face customer service. Past research shows that people like the convenience and easy access of online banking, but many still worry about how safe their money and personal information are. This study will use focus groups and surveys to learn more about what customers think and feel about online banking. The expected results will show which concerns matter most and what fully digital banks, such as Ally Financial, can do to make customers feel more comfortable. This research is important because online banks need to build trust, protect customer information, and make people feel secure if they want to attract and keep more customers.

Fold, Create, Connect: Zines as Arts-Based Health Communication

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This project looks at using zines to disseminate health information and individual experiences. Zines are small magazines that combine writing, photos and drawings. Particular attention is given to how communities participate in creating and sharing zines about health issues that matter to them. As part of the development of a handbook chapter, an undergraduate research assistant reviews scholarship on zine history, arts-based research, health education, and community advocacy. Relevant evidence and quotations are recorded with page numbers, and sources are organized by theme to support the chapter's development. So far, the research reviewed portrays zines as a flexible way to share lived experiences alongside health information. Research on health-related zines also calls for reflection on issues of accessibility, representation, collaboration, and whose knowledge is given credence. This project brings various sources together to study the possibilities and limitations of zines as tools for communicating about health to diverse audiences in varied settings

Evaluating Responses to Natural Extract Treatments in Arabidopsis thaliana Infected With Pseudomonas syringae pv. tomato

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The widespread use of typical pesticides and fungicides to prevent crop infection present significant risks to the health of humans and the environment. Therefore the development of a natural, environmental and human friendly alternative that can successfully mitigate crop infection is vital to the success of sustainable agriculture. Natural extracts containing secondary plant metabolites have been proven to have synergistic effects on plant health and disease management, making them a beneficial solution. Crude ethanolic extracts were created from the leaves of three trees native to Western North Carolina: Asimina triloba (Paw Paw), Liquidambar styraciflua (American Sweet Gum), and Juglans nigra (Eastern Black Walnut). These extracts were tested for antimicrobial properties against the pathogen Pseudomonas syringae p.v Tomato, the casual agent of tomato speck, as well as their ability to promote the expression of the defensive gene PR1 in an Arabidopsis thaliana reporter model through GUS staining and RT-qPCR. Initial findings show that Liquidambar styraciflua exhibits antimicrobial activity, making it a strong candidate for a natural alternative to pesticides. Further research will be conducted on the induction of the PR1 gene post treatment with crude extracts.

Investigating the Synergistic Effect of Heme on Artemisinin-induced Ferroptosis in Cancer Cells

Mariangel Noriega

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Catawba College

Artemisinin (ART), a sesquiterpene lactone endoperoxide, has been studied for its potential as an anti-tumor therapeutic. In tumor cells, the proposed mechanism suggests that ART is activated by iron and heme, generating reactive oxygen species (ROS), disrupting iron metabolism, and inducing endoplasmic reticulum stress. Many cancers undergo “heme overdrive,” increasing heme synthesis to support rapid proliferation, which may be exploited for selective ART activation. Preliminary viability assays suggest that ART and heme, in combination, synergistically inhibit the growth of MCF7 and HeLa cancer cells, with the most significant inhibition occurring at 100 μM ART and 100 μM heme ($p < 0.005$) at 24, 48 and 72 hour timepoints. Enhanced lipid peroxidation was observed in the co-treatments, with the most occurring in the 100 μM ART and 100 μM heme ($p < 0.005$). Preliminary western blot analysis demonstrated diminished levels of GPX4, a key protein involved in preventing ferroptosis, across all ART treatment conditions compared to control, with the lowest expression observed in cells treated with both 100 μM ART and 100 μM heme. Continuing work will investigate the selective toxicity of ART and heme using a non-tumorogenic cell line, MCF12a, in addition to testing ART/heme interactions in various cancer types, such as in ES2 (ovarian). Collectively, these studies aim to clarify whether ART and heme selectively trigger ferroptotic death in cancer cells by exploiting their elevated heme metabolism, further advancing our understanding of ART/heme interactions in cancer cells, and how this phenomenon may be exploited for chemotherapeutic use.

Designing Trustworthy AI Recommendations for Engineers: Human-in-the-Loop Interfaces, Explainability, and Cognitive Bias

Ema Nova

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After developing interface mockups for Bowtiefy, a platform that helps engineers create risk diagrams, over the summer, we identified a broader research question: How can interface design reduce cognitive bias when engineers evaluate AI-generated recommendations in high-risk decision-support systems? To investigate this question, I will review existing research to identify common patterns related to AI trust, decision-making, and cognitive bias. I will be focusing on three cognitive processes: automation bias, confirmation bias, and anchoring bias which may influence how engineers interpret and evaluate AI recommendations. Previous research suggests that explanations and transparency do not always improve decision-making and may sometimes lead users to place more trust in AI than the recommendations deserved. Understanding these challenges is particularly important in engineering risk context, where decisions can affect safety and require careful evaluation of evidence and potential consequences. I will also revisit our past interface mockup for Bowtiefy and compare existing AI-powered interfaces and examine how they present recommendations, explanations, uncertainty, and opportunities for users to maintain control.This analysis will inform a matrix connecting each cognitive bias to potential design solutions. Finally, I will apply the findings to annotated Bowtiefy interface examples to explore how human-in-the-loop design can support engineers' judgment rather than replace it. The expected contribution of this research is to develop a practical framework for designing AI recommendation interfaces that support informed human decision-making in engineering risk contexts.

Freight Safety Corridors in Charlotte: A Corridor-Based Assessment of Truck-Involved Crash Risk and Severity

Cooper Oates

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Freight movement is essential to the Charlotte-Mecklenburg region, but the increasing movement of large trucks through urban and regional transportation networks creates important challenges for roadway safety. This research asks: Where are truck-involved crashes concentrated within Charlotte-Mecklenburg, and which freight corridors experience the greatest combination of crash frequency and severity? Previous transportation safety research has commonly used crash frequency, crash rates, and hotspot analysis to identify areas of concern; however, these approaches may overlook how crash severity and the corridor-level movement of freight influence overall safety risk. This study uses geographic information systems (GIS) to examine truck-involved crashes in Charlotte-Mecklenburg from 2015–2025 and identify patterns along major freight corridors. Crash records are spatially joined to the roadway network and analyzed based on crash frequency, injury severity, and corridor characteristics. Additional roadway and freight-related variables, including interchange density, access points, speed environments, and proximity to freight-generating activity, are examined to identify potential factors associated with elevated crash risk. Preliminary analysis indicates that truck-involved crashes are concentrated along major regional freight routes, including I-85, I-77, I-485, and US-74. The research will develop a corridor-based framework for identifying locations that warrant additional safety investigation. The findings can support transportation agencies in understanding freight-related safety patterns and inform future roadway safety planning, engineering analysis, and targeted countermeasure development.

Computational Design and Experimental Validation of a Reversible Dual MAO-A/MAO-B Inhibitor for Parkinson's Disease

Chigozie Obi

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North Carolina School of Science and Mathematics

Parkinson's disease (PD) is a neurodegenerative disorder characterized in part by the progressive loss of dopaminergic neurons and resulting depletion of dopamine in the basal ganglia. This motivates therapeutic strategies that increase dopamine levels and preserve dopamine signaling. Monoamine Oxidase (MAO) is a mitochondrial enzyme that regulates brain function by breaking down monoamine neurotransmitters like dopamine through oxidative deamination. MAO exists as two isoforms, MAO-A and MAO-B, which differ in substrate preferences and distribution throughout the body. Inhibiting these enzymes can therefore modulate neurotransmitter availability, motivating compounds capable of targeting one or both MAO isoforms. This project aims to computationally design and experimentally validate a reversible dual MAO-A/MAO-B inhibitor with potential application to PD treatment. Structure-based drug design was performed using experimentally determined MAO-A and MAO-B structures in Schrödinger Maestro, incorporating molecular docking and structure-based pharmacophore analysis to identify interactions associated with inhibitor binding. A focused library of MAO inhibitors was evaluated to characterize structure-activity relationships and guide lead optimization. A chalcone-derived candidate, (E)-3-(benzo[d][1,3]dioxol-5-yl)-1-(2-fluorophenyl)prop-2-en-1-one, was selected for experimental validation based on predicted binding properties and established drug-design criteria. The candidate will be evaluated using a recombinant human MAO inhibition assay to determine inhibitory activity, followed by concentration-response analysis and experiments assessing recovery of enzymatic activity after inhibitor removal or dilution as evidence of reversibility. This study seeks to establish a workflow for developing reversible MAO inhibitors by integrating computational design and biochemical validation, while providing a framework for computationally designing inhibitors targeting multiple MAO isoforms.

Disposable Bodies: Homelessness and Necropolitics in Modern Capitalism

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Systemic hardship and scrutiny against homeless people are ingrained in modern capitalism, as exemplified within American society. Negative public perception of the unhoused is embedded in legal precedent, government structure, architectural design principles, and the general treatment of unhoused people as nuisances. In modern capitalism, homelessness functions as a structural threat; its visibility produces fear of dispossession, encouraging compliance with exploitative conditions and undermining working-class solidarity. From the overturning of Martin v. Boise to the flawed assumption that homelessness is a reflection of work ethic within what is touted as a meritocratic society, unhoused people are subjected to premature death. In this project, I argue that unhoused people constitute a severely disadvantaged class that is increasingly excluded from stable participation in capitalist economic life; because they are excluded and thus increasingly non-exploitable, the unhoused are not viewed as worth investing in and are subjected to death-producing conditions, including exposure to extreme weather, violence, disease, and overpolicing, and are actively gatekept from regaining financial mobility. By analyzing the necropolitical management of excess (à la Mbembe) as it manifests through unhoused populations, this paper shows that homelessness is an almost necessary conclusion of capitalism for those who cannot be exploited, and thus the unhoused are reduced to mere bodies and subjected to death. In response to the death-dealing that unhoused people are subjected to, my project concludes with an investigation and assessment of approaches that would reduce homelessness and center empathetic, life-giving, and humane responses to the homelessness crisis.

Reusable Carbon Quantum Dot-Based Solvent-Responsive Molecularly Imprinted Fluorescent Sensor Chip for the Detection of PFOA

Hannah Oh

Mentored by: Timothy Anglin

North Carolina School of Science and Mathematics

Despite widespread reliance on molecularly imprinted polymers (MIPs) in sensing technology, an underexplored area remains: whether the repeated use of harsh solvents to wash out the template molecule, which can make binding one-time and non-reversible, has alternatives that allow sensor reusability. This study presents a solvent-responsive MIP (S-MIP) sensor for detecting perfluorooctanoic acid (PFOA), a persistent PFAS "forever chemical," in water. The S-MIP was synthesized by free-radical polymerization of methacrylic acid (MAA) as the functional monomer and triethylene glycol dimethacrylate (TEGDMA) as a flexible cross-linker designed to enable solvent-responsive reusability, with methacrylated β-cyclodextrin (β-CD-MA) as a host for PFOA. The sensor incorporated nitrogen-doped carbon quantum dots into the MIP to provide a fluorescence signal that decreased upon PFOA binding. Over repeated solvent-switching cycles, the MIP recovered molecular recognition capability, enabling reuse. The resulting MIP demonstrates a model process for synthesizing an inexpensive, reusable fluorescent recognition sensor for PFOA, opening avenues for research into regenerable sensors for other environmental contaminants.

Exploring Matter and Meaning: Quantum Mechanics Between Karen Barad and Bill Brown

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Science and philosophy have long been intertwined, nearly inseparable in debates about the relationship between matter and meaning. Yet a critical question remains: whether quantum mechanics grounds or merely illustrates the ontology of that relation. This study explores how one can interpret meaning in matter through a close reading of two works: Meeting the Universe Halfway by Karen Barad and Thing Theory by Bill Brown, and asks whether Barad's physical premise is necessary or whether Brown reaches comparable conclusions without extending science beyond its domain. Proposing agential realism, Barad interprets quantum physics as implying a New Materialism of dynamic matter that entangles human interaction with matter itself; Brown proposes a different view, focused on "thingness" as a subject-object relation, in which objects shape our perception of them. Preliminary analysis suggests that a crucial difference separates Barad's ontological account from Brown's relational one, and that Barad's extension of quantum mechanics into philosophy is what supports it. This gap raises a broader question about what theories gain and risk when they extend scientific principles into philosophy.

How Food Inflation Affects Human Health and Mental Health

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Food prices in the United States have faced multiple inflationary pressures in recent years, creating significant financial strain for consumers. While economic factors, such as inflation, are often considered, the impact of food price inflation on human health and psychological well-being is rarely synthesized. This literature review examines how food inflation affects physical and mental health in the United States. The review synthesizes peer-reviewed articles across multiple disciplines, including economics, public health, and psychology, spanning from 2008 to 2026. Findings center on three themes: 1) food inflation is directly linked to increased food insecurity, 2) it affects dietary quality by forcing vulnerable populations to shift towards cheaper, less nutritious options, and 3) it contributes to psychological distress and financial stress. These findings suggest that inflationary pressures are not only limited to economic concerns, but also function as an important public health concern that entails dietary health and intensifies anxiety, depression, and prolonged stress. Further, the findings provide an interdisciplinary synthesis of evidence across economics, public health, and psychology, emphasizing how inflationary pressures create physical and mental health vulnerabilities.

Same Task, Different Author: Comparing Human and AI Code Security

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A growing share of software is written with AI assistance. Google reports substantial internal use of AI-generated code, while GitHub Copilot integrates code generation directly into developers' editors. These workflows often produce small snippets or individual functions, making the security of isolated code fragments an important concern. Both AI-generated and human-written code can contain vulnerabilities, but it remains unclear how they compare when solving the same tasks. Existing comparisons face two major challenges. First, many security scanners require complete projects and cannot analyze short, isolated functions. Second, human and AI code found in the wild typically solve different problems, making it difficult to determine whether security differences come from the implementation or the task itself. We address this by building a matched benchmark of human and AI-written implementations of the same tasks. Starting with 100 real functions from open-source projects, we derive implementation-neutral task descriptions and use them to prompt models including ChatGPT, Gemini, Gemma, and Qwen. This will produce approximately 500 functions covering the same 100 tasks. Shared functional tests will verify that implementations satisfy the same requirements. We will then analyze each function using static analysis tools, including Redlyne and Semgrep, and manually review reported findings. This pilot will provide an initial basis for comparing security findings in human- and AI-generated code while evaluating the limitations of tools designed to analyze isolated code fragments.

Understanding the associations between future-oriented thinking, personality, and types of exercise motivation in underactive individuals to inform physical activity promotion

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Mentored by: Sara Levens

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Physical activity is very important for health and wellbeing, yet most individuals find engaging in physical activity difficult. One's willingness to exercise can be influenced by their ability to delay gratification of future consequences, as well as by personality. Future oriented thinking and personality may also influence different types of physical activity motivations differently. The study aims to clarify how future-oriented thinking, personality, and types of exercise motivation are associated in underactive individuals with the larger goal of understanding individual differences in health behavior and self-regulation. Underactive adults (n=184; Mean age=43.02, SD=12.65; 75% female) participating in a six week physical activity intervention completed measures of consideration of future consequences (CFC), and personality (mini IPIP; extraversion, openness, agreeableness, neuroticism, conscientiousness), and exercise motivation (BREQ; identified, intrinsic, integrated) at baseline. A correlation analysis among the consideration of future consequences, personality, and exercise motivation variables revealed significant associations between consideration of future consequences and the personality variables of conscientiousness and neuroticism (ps <.05), but not openness, extraversion, or agreeableness. In terms of personality and exercise motivation, there were significant associations between conscientiousness and identified, intrinsic, and integrated exercise motivation (ps <.05), as well as between openness and introjected motivation (p <.05). In addition, amotivation was negatively associated with extroversion, agreeableness and conscientiousness. Finally, consideration of future consequences was significantly associated with identified, intrinsic, and integrated exercise motivation (ps <.001). These results could inform tailored physical activity intervention development for underactive adults to promote an active lifestyle.

Vanillin-Derived Polymers: A Sustainable Path to High-Efficiency Organic Solar Cells

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Mentored by: Jeromy Rech

University of North Carolina at Asheville

Organic solar cells (OSCs) are a developing technology in the field of renewable energy. Compared to conventional silicon solar panels, which are bulky and expensive, OSCs are cost-effective, easy to fabricate, flexible, and lightweight. Many of these features are based on the conjugated polymer used in the device; however, an important drawback for conjugated polymers comes from their synthesis from petroleum-based feedstocks, which are nonrenewable and thus environmentally detrimental. There are a variety of biofeedstocks options, but not a lot which share the same structural features for high-performance conjugated polymers. Vanillin is an abundant aromatic compound that has seen widespread applications in cosmetic formulations, pharmaceuticals, and culinary industries. We are especially interested in exploring chemistries to convert vanillin into the key monomers needed for a conjugated polymer, such as the PTQ-10 polymer popularly seen throughout OSC literature. The “Q” in PTQ-10 represents the quinoxaline core, which is traditionally synthesized from petroleum-based benzenediamine compounds. Inspired by literature, we have designed a synthetic pathway to synthesize PTQ-10 from a vanillin starting feedstock. While not every chemical in this process is obtained through biomass, this work represents a huge step forwards to improving the sustainability of PTQ-10.

Examining Geographic Disparities in Diabetes Burden and Resource Access in Eastern North Carolina

Andrew Ormond

Mentored by: Brandon Jones

East Carolina University

In rural Eastern North Carolina, many communities face barriers to accessing healthcare, nutritious food, and preventative health education, contributing to a higher prevalence of diabetes. Although previous research has examined socioeconomic and geographic disparities in diabetes outcomes, less is known about whether diabetes-related resources align with areas of greatest community need. This study examines the geographic alignment between diabetes prevalence and access to food, healthcare, and diabetes education and prevention resources across 41 counties in Eastern North Carolina. ArcGIS Pro was used to integrate publicly available data from the Centers for Disease Control and Prevention, U.S. Census Bureau, U.S. Department of Agriculture, and Health Resources and Services Administration. County-level diabetes prevalence, socioeconomic characteristics, food access indicators, and healthcare resources were spatially analyzed alongside geocoded diabetes education and prevention services. Results revealed substantial overlap between diabetes burden and socioeconomic disadvantage. Over half of the counties (n=26, 63.4%) had diabetes prevalence and poverty rates above the state of North Carolina average. Twenty-three counties (56.1%) experienced both elevated diabetes prevalence and above-state poverty. Healthcare resources were unevenly distributed, with five counties (12.2%) having no active HRSA health-center site, including three (7.3%) with diabetes prevalence exceeding the state average. These findings identify geographic disparities between diabetes burden, socioeconomic conditions, and resource availability and provide a framework for prioritizing diabetes prevention, education, healthcare, and food-access programming in Eastern North Carolina.

Modeling and Validating Carbon Resource Competition in Synthetic Microbial Communities

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North Carolina State University

Within the rhizosphere, plant root exudates shape interactions with diverse rhizobacteria, where microbial activity can benefit plant health and nutrient acquisition. In turn, nutrient availability and resource competition shape bacterial growth and interactions within these communities. Genome-scale metabolic (GEM) models have been used to predict microbial growth and metabolic interactions based on available resources, yet the accuracy of these predictions in rhizosphere communities remains to be experimentally validated. This project evaluated the ability of GEM-based flux balance analysis (FBA) to predict rhizobacterial growth using glucose and citrate as carbon sources and in competitive co-culture conditions. Using individual and pairwise kinetic growth assays of nine rhizobacterial species, growth was monitored using OD600 measurements, with fluorescence-based measurements used for co-cultures. Experimental growth rates were then compared with model predictions to evaluate accuracy. Comparisons showed a greater proportion of species exhibited higher growth on glucose than on citrate and demonstrated less agreement between experimental and predicted growth rates in co-cultures than in individual strains. In co-cultures containing Pseudomonas putida, FBA predicted decreased partner growth in both glucose and citrate, whereas experimental growth showed minimal effects or increases in partner growth. These findings indicate that FBA can predict bacterial growth under some conditions but has limitations in predicting growth within competitive microbial communities. Experimental validation can help identify opportunities to refine GEM-based predictions, potentially improving our understanding of rhizobacterial contributions to plant nutrient acquisition and informing strategies for improving plant nutrition overall.

Investigating the Role of SKI in Enhancing CD8+ T cell Anti-Tumor Immunity

Lensa Osena

Mentored by: Yisong Wan

North Carolina School of Science and Mathematics

$CD8^+$ cytotoxic T cells play a critical role in antitumor immunity by killing cancer cells. Within the tumor microenvironment, transforming growth factor-β (TGF-β) suppresses cytotoxic T cell activity and promotes T cell exhaustion through chronic signaling, limiting effective antitumor immunity. Since the Sloan-Kettering Institute (SKI) protein acts as a repressor of the TGF-β signaling pathway, it has the potential to restore antitumor function in $CD8^+$ T cells. However, the role of endogenous SKI in regulating $CD8^+$ T cell function during melanoma progression remains poorly understood. In this study, we investigated whether overexpression of SKI in $CD8^+$ T cells enhances antitumor cytotoxic activity against melanoma. Using an in vitro tumor-killing assay and tumor growth monitoring, we compared the tumor-killing capacity of wild-type and SKI knock-in (SKI-KI) $CD8^+$ T cells in vitro and in vivo. B16-GP33 melanoma cells were cultured to act as the targets in the T-cell-melanoma co-culture, while the B16-GP33 melanoma mouse model was used for tumor growth and adoptive cell transfer. We found that SKI-KI expression significantly enhanced $CD8^+$ T cell-mediated control of B16 melanoma in vivo and in vitro. Compared with wild-type cells, SKI-KI $CD8^+$ T cells slowed tumor growth in mice across multiple experimental models. Across multiple effector-to-target ratios, SKI-KI $CD8^+$ T cells lysed a greater percentage of melanoma cells than wild-type T cells. These findings identify SKI as a key regulator of $CD8^+$ T cell function that enhances resistance to TGF-β-mediated immunosuppression and highlight its potential as a target for improving cellular immunotherapy against solid tumors.

Coyote Detection and Activity Patterns Across Natural and Recreational Landscapes

Madison Owen

Mentored by: Sara Gagne

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Human development and recreational activity can alter wildlife habitat use and behavior, yet adaptable species may persist in human-dominated landscapes by modifying their spatial or temporal activity. Coyotes (Canis latrans) are behaviorally flexible predators that occupy both natural and developed environments. Previous camera-trap studies have shown that coyotes may continue to use human-influenced areas while shifting their activity toward nighttime hours to reduce encounters with people. Human presence and infrastructure may also affect coyotes differently, with recreation trail density and proximity to urban-wildland boundaries influencing nocturnal activity. We will use data collected from motion-activated camera traps at Reedy Creek Nature Preserve and Harrisburg Road Sports Complex in Mecklenburg County, North Carolina, as part of Snapshot USA, a broader collaborative wildlife camera-trapping survey. We will use these data to investigate whether coyote detection frequency and activity timing differ between a natural preserve and a more developed recreational landscape. We hypothesize that differences in human development and recreational activity between the two sites will influence coyote detection frequency and temporal activity patterns. Based on previous research showing that larger predators may avoid human presence temporally rather than completely avoiding human-influenced habitats, we predict that coyotes will be detected at both locations but will exhibit a greater proportion of nighttime detections at Harrisburg Road Sports Complex, while detections at Reedy Creek Nature Preserve will occur across a broader range of times. Comparing coyote activity between these landscapes will provide insight into how coyotes adjust their behavior in response to varying levels of human development and recreation.

Examining Organizational and Behavioral Factors of AI Adoption in Healthcare

Samantha Owens

Mentored by: Vinayaka Gude

Elon University

Generative AI is rapidly being adopted throughout the healthcare system, where it now helps write clinical notes, summarize medical records, and explain diagnostic findings to patients. Most research on patients and healthcare AI has focused on trust and acceptance, showing that patients are more comfortable when a clinician stays involved and that the way a system's role is described matters. Far less attention has gone to whether patients actually understand what the system did, because most studies ask only whether patients feel informed. Higher trust may therefore rest on an incomplete or inaccurate picture of the system. This study examines how patients respond when a generative AI system helps explain a diagnosis. Participants will view randomized scenarios in which the reading of an X-ray is attributed to a radiologist, to the system on its own, or to the system with a clinician review, and in which the explanation of how the result was reached and the chance to ask follow-up questions are varied. Participants will see a series of results whose accuracy varies without their knowledge, which allows us to observe whether their willingness to seek a second opinion follows whether a result was in fact correct. We expect explanation and clinician involvement to raise trust and stated understanding while leaving that judgment largely unchanged. The work will give healthcare organizations evidence for how to tell patients that a computer system helped with their care and will show whether these messages leave patients well informed, unnecessarily worried, or falsely confident.

Ion Motion in Organic Conductors for Neuromorphic Devices

Grant Ozaki

Mentored by: Paschalis Gkoupidenis

North Carolina State University

Neuromorphic computing may revolutionize the computational landscape by providing an energy-efficient, interconnected network of functional artificial neurons. A bio-inspired approach to neuromorphic computing can help enable adaptive prosthetics, overcome AI processing limitations, and improve autonomous vehicle behavior through real-time feedback. These feedback mechanisms are fundamentally driven by ion movement in the brain. This research measures how far ions move over time, providing a numerical basis for studying bio-inspired electronic devices that emulate ion transport in biological systems. A thin conductive polymer film (PEDOT:PSS) was deposited on glass, and electrical pulses were used to drive ions through the material. Videos were recorded at 100 fps, and voltage-induced color changes in the material were used to track ion movement over space and time. Electrical parameters and ion conditions were varied to identify changes in neuronal firing behavior and extract spatiotemporal constants. Results indicated that increasing the duty cycle, period, or concentration of ions generally increased the ion propagation length. These findings suggest that electrical stimulation can shape ion propagation dynamics, and therefore lead to new concepts in electronics for the efficient transfer and processing of information.

Countering Social Harm: Acceptability & Feasibility of an Adapted LGBTQ+-inclusive Violence Prevention Training

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Mentored by: Jessamyn Moxie

University of North Carolina at Charlotte

Lesbian, gay, bisexual, transgender, and queer (LGBTQ+) emerging adults (18-25) experience higher rates of sexual and intimate partner violence. LGBTQ+ communities experience worse health outcomes due to social discrimination and stigma. Because many survivors first disclose their experiences to friends, supportive peer responses play an important role in survivor healing. To address these disproportionate rates of violence, Supporting Survivors and Self+ (SSS+) was adapted from a previous intervention to focus on improving peer-to-peer responses to disclosures of sexual violence. In order to evaluate implementation outcomes, including feasibility and acceptability, of the adapted training, four SSS+ sessions were conducted in April 2026. Participants (N=30) completed a post-training survey to assess acceptability, appropriateness, usability, feasibility, and program differentiation, utilizing Likert-style questions ranked 1–5. Results showed high median scores across all five measures, ranging from 4.78 to 4.51. Qualitative findings identified that participants rated the training highly across all implementation outcomes, with participants describing the training as engaging, interactive, and relevant. These results highlight the importance of adapting sexual violence response trainings to specific populations, considering today's climate. Funding issues for LGBTQ+ focused research projects have created an unsafe environment and extremely difficult landscape for conducting research. We have learned to be resilient for the communities we seek to serve. Because research is rarely considered to be neutral, the way we engage with and discuss these topics is the defining approach for the basis of our initiative.

Post-Immigration Dietary Change Across North and South Indian Regional Backgrounds Among Asian Indian Adults in North Carolina

Aryan Pal, Srihithaa Vaidya

Mentored by: Satomi Imai

East Carolina University

Asian Indian adults are at increased risk for type 2 diabetes (T2D), and dietary behaviors relevant to T2D risk may change after immigration to the United States based on regional food traditions, length of U.S. residence, and changes in food access and preparation. North and South Indian populations have distinct dietary patterns, yet little is known about whether their dietary behaviors change differently after immigration because studies often examine Asian Indian immigrants together. This study examines how T2D-relevant dietary patterns change after immigration among first-generation Asian Indian adults living in North Carolina and whether these changes differ between North and South Indian backgrounds. We developed a cross-sectional, retrospective survey for adults aged 45 or older who were born in India, immigrated to the United States after age 18, and reside in North Carolina. The survey compares dietary behaviors before immigration with intake during the past year, including refined and whole grains, fried foods, added sugars, sugar-sweetened beverages, sweets, ultra-processed foods, restaurant foods, and home-prepared foods. Additional measures include years lived in the United States, regional origin in India, first-degree family history of T2D, physical activity, prediabetes/T2D history, physician counseling, and demographics. Paired dietary items will be classified as increased, unchanged, or decreased after immigration and compared between North and South Indian groups. We expect the groups to demonstrate different patterns of post-immigration dietary change, with variation by duration of U.S. residence. Findings may identify modifiable T2D risk factors and inform culturally relevant dietary education and prevention strategies.

Substance Use and Pregnancy

Kriti Palaparthy, Sonika Pattila

Mentored by: Kennicia Fortson

University of North Carolina at Charlotte

Substance use among women of reproductive age is a public health concern as exposure may occur early in pregnancy before a woman is aware that she is pregnant, creating risks for maternal health, pregnancy outcomes, and long-term child development. This literature review examines substance use during the preconception and early pregnancy periods among reproductive-age women and how these behaviors influence pregnancy and long-term health outcomes. It also explores why substance use (e.g. alcohol use, tobacco products, illicit drugs, etc.) could potentially occur and how prevention and intervention strategies can help address early exposure. Current literature published between 2013 and 2026 was reviewed through UNC Charlotte's Atkins Library search system and databases, using terms related to substance use, mental health, pregnancy, outcomes, and prevention to identify relevant articles. Findings suggest that substance use often begins before pregnancy and is influenced by established behavioral patterns, mental health conditions, unintended pregnancy, social pressures, and barriers to healthcare. Early substance exposure, depending on the substance and pattern of use, is associated with increased risks of miscarriage, early birth, low birth weight, and long-term developmental and health concerns. Evidence also suggests that many women reduce or stop substance use after pregnancy recognition, suggesting that behavior change and risk reduction are possible. The literature strongly reinforces the importance of beginning prevention efforts before pregnancy and continuing support throughout the reproductive years. Integrated approaches that combine preconception prevention strategies, peer education programs, screenings, and technology-based social support can help reduce the use of substances among reproductive-age women.

The Difference in Reward Sensitivity in ADHD vs Neurotypical Individuals on a Dopaminergic Level

Bhavani Pruthvik Palpanoori

Mentored by: Norine Ho

North Carolina School of Science and Mathematics

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by repeated inattention, hyperactivity, and impulsivity, with growing research suggesting differences in reward and punishment sensitivity related to dopaminergic signaling and reinforcement processing. This project examines how research on reward sensitivity in ADHD has developed, with particular focus on the question of how reward sensitivity differs in ADHD versus neurotypical individuals at the level of dopaminergic signaling and behavior. Previous research has examined behavioral mechanisms including delay aversion, executive dysfunction, inhibitory control, and decision-making, while more recent work has increasingly investigated reward-related neural circuitry, reinforcement learning, and dopaminergic mechanisms. A bibliometric analysis was conducted using the Web of Science Core Collection, from which the 100 most-cited publications relating ADHD to reward and reinforcement processing were identified. The dataset included 93 articles and 7 reviews published between 1995 and 2025, including 59 journals, 78 senior authors, and 6,979 citations. Metadata were analyzed using R and the bibliometrix package with its Biblioshiny interface to examine publication trends, author and country productivity, source journals, citation patterns, and keyword co-occurrence. Results indicated a shift from behavioral models toward neurobiological investigations of reward processing, with research output peaking between 2008 and 2019. These findings demonstrate the growing emphasis on dopaminergic signaling and reward-related neural circuitry and highlight the importance of continued mechanistic research for understanding motivational differences in ADHD.

Effects of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Exposure on Gene Expression, Oxidative Stress, and Neurodevelopmental Markers

Sanvi Pandit

Mentored by: Ashley King-Bennett

North Carolina A&T State University

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), a toxic contaminant of Agent Orange that has been associated with neurological and developmental effects; the factors gene expression, oxidative stress, and neurodevelopmental outcomes are often examined separately. This study investigated how these three factors are interconnected following TCDD exposure. The goal of this research was to produce a cause-and-effect chain that explains how TCDD affects gene expression, oxidative stress, and neurodevelopmental markers. A meta-analytic approach was used to synthesize findings from 25 academic papers. Studies were selected based on the presence of quantitative data related to TCDD exposure, including gene expression, oxidative stress, and neurodevelopmental markers. Exposure levels ranged from 0.001 to 100 μg/kg. Data was compared using averages and percentage changes. The analysis identified widespread transcriptional disruption following TCDD exposure, with approximately 6,700 genes affected across the studies. Detoxification genes, specifically CYP1A1 and CYP1B1, showed increases, with CYP1A1 increasing approximately 65- to 300-fold. These transcriptional changes were associated with increased reactive oxygen species and oxidative damage, including approximately 400–500% increases in lipid peroxidation, up to 600% increases in DNA oxidative damage, and an approximately 80% decrease in glutathione. These molecular changes were linked to mitochondrial dysfunction, cellular senescence, apoptosis, structural brain changes, and cognitive and behavioral impairments. The findings support an interconnected pathway where TCDD-induced AhR activation alters gene expression, promotes oxidative stress, and contributes to neurodevelopmental disruption. This synthesis provides a structure for understanding TCDD toxicity across multiple biological levels.

Airflow and heat sink cooling for data centers

Danielle Panzo

Mentored by: Pablo Nunez Hernandez

East Carolina University

Processors in data centers to be cooled to avoid overheating and damaging electronic components. Literature on forced-air cooling indicates that heat sink efficiency depends on air velocity and flow pattern, such as bypassing air. This research will compare two heat sinks in a controlled setting to see whether directing air through the fins can increase cooling at the same fan speed. A testing duct has been designed which includes a honeycomb-shaped duct entry, an adjustable-speed exhaust fan, a film heater for simulating a processor, and a removable heat sink mounting. Air velocities and different levels of heating will be analyzed in experiments. Temperature sensors, a hot-wire anemometer, and heat flux sensors will be used for measuring temperature, air velocity, and heat exchange rate respectively, with the heater power recorded as well. The test conditions will be repeated once the steady state is achieved. Surface temperature, thermal resistance, and heat exchange rate will be analyzed. Increasing air speed is expected to improve cooling, with smaller gains at higher speeds. This study will provide a repeatable experimental method and data to support heat sink selection, airflow management, and future data center cooling models.

From Road to Rest: The Role of Transition Time in Recovery

Carter Pape

Mentored by: Erika Lopina

Elon University

Previous research has shown that individuals engage in microbreaks and postwork activities (e.g., working out, reading a book, etc.) to facilitate recovery from job strain. The current research explored how recovery from job strain is experienced between work and home, specifically, during the post-work commute. Two key commute characteristics are impedance (i.e., traffic, interruptions, pollution) and environment (i.e., natural scenery). Based on the Environmental Demands and Resources Model (Hilbert et al., 2025), commute impedance was predicted to reduce postwork recovery whereas commute environment was predicted to improve postwork recovery. Participants completed daily diary surveys (7 commuting days) measuring commute characteristics (impedance and environment) and recovery (restoration and affect). Participants were faculty and staff (current n=31; age, M=43.33, SD=13.37; gender identity, 67% female, 30% male, 3% preferred not to say) from a mid-sized university recruited via snowball sampling. Commute distances ranged from 1 to 95 miles (M=21.57, SD=21.89), and from 4 to 90 minutes (M=29.80, SD=22.33). Preliminary correlational analyses of completed Day 1 surveys indicated that commute impedance was not significantly correlated with restoration but was significantly correlated with negative affect. The commute environment was moderately, positively correlated with restoration and positive affect. Thus, commutes with greater impedance, or demands on the commute, are associated with greater negative emotions whereas commutes with natural environments may facilitate both restoration and positive emotions. These findings provide insight into how commute characteristics are associated with recovery. Data collection will continue, and multilevel analyses are planned to further investigate these relationships over time.

Banking on Gen Z: How Ally Bank Can Connect with the Next Generation

Kiley Pappas, Brynn Fogarty

Mentored by: Steven Cox

Queens University of Charlotte

This project investigates Generation Z's attitudes, behaviors, and priorities regarding banking to identify strategies Ally Bank can use to better attract and connect with younger consumers. Existing research suggests that Gen Z's expectations for financial institutions are influenced by factors such as digital banking experiences, financial knowledge,perceived value, and evolving financial priorities. To establish this research context, we conducted a literature review examining Gen Z banking behaviors, mobile banking adoption, and Ally Bank's current marketing strategies, supplemented by insight from a member of Ally's marketing research team. Our methodology combines this secondary research with primary research conducted through surveys and focus groups examiningGen Z's banking knowledge, preferences, behaviors, and perceptions. We expect our findings to indicate that the challenge extends beyond a disconnect between Ally Bank andGen Z specifically and may reflect a broader lack of engagement with and understanding of banking among younger consumers. These findings may support a marketing strategy that emphasizes financial education and communicates banking benefits according to the priorities of Gen Z consumers. Ultimately, this research aims to provide Ally Bank with actionable insights for building relationships with the next generation of banking customers and remaining competitive as their financial needs and expectations develop.

Improving the Escalier Algorithm

Tevin Parathattal

Mentored by: Sebastien Bossu

University of North Carolina at Charlotte

We investigate methods for improving the Escalier algorithm, a sweep-search method for fitting optimal step functions ("escaliers") to curves, introduced by Bossu, Papanicolaou, and El Hatto (2025). The original algorithm relies on a fixed-precision sweep to locate critical points satisfying the fitting problem's first-order conditions, trading off accuracy (R^2) against computation speed and requiring costly repeated numerical integration at each step.This project explores alternative computational approaches aimed at improving both the precision and speed of the fit. We examine Chebyshev polynomial approximation of the target function as a way to replace direct numerical integration with fast, closed-form evaluation, enabling broader and more efficient search over candidate step positions. We also investigate Gröbner basis and related polynomial system-solving methods as an alternative to sweep search for directly locating all critical points of the fitting equations, rather than relying on a single search path. Each approach is evaluated against the original algorithm's own benchmark functions and precision settings, with runtime and R^2 serving as the primary measures of improvement.Preliminary results indicate that these methods can substantially reduce evaluation cost and reveal solutions of varying quality that a single sweep search may not locate, particularly for the algorithm's more difficult oscillatory test cases. Ongoing work focuses on determining which techniques offer the most reliable gains in speed and accuracy across different function types.

Evaluating the Link Between BRCA1 Protein Domains and Variant Severity Using NIH Clinical Data

Charvi Parikh, Navya Sharma

Mentored by: Ripal Parikh

North Carolina School of Science and Mathematics

Pathogenic germline mutations in the BRCA1 tumor suppressor gene increase lifetime risks for hereditary breast and ovarian cancers by substantial rates. Despite this, thousands of identified genetic variants remain classified as Variants of Uncertain Significance (VUS). This study is designed to investigate the distribution of pathogenic versus VUS missense mutations across functional protein domains of BRCA1. The purpose of this study is to identify structural hotspots that can be associated with elevated risks for hereditary cancers. In order to conduct this study, publicly available clinical genetic data from the National Institutes of Health (NIH) ClinVar Database was utilized to extract and analyze missense mutations recorded for the BRCA1 gene. To do so, BRCA1 mutations were grouped by clinical significance and were tracked based on where they appear on important parts of the protein. Within this, Chi-square independence tests will be conducted to evaluate whether pathogenic variant density differs significantly by domain location. This research hopes to discover a significant grouping of harmful mutations, inside important working areas while VUS entries are expected to be spread out more evenly in areas that are not functional regions. These predicted results show that changes that affect working areas are more likely to be harmful providing a way based on data to help doctors understand genetic changes. In the end, this genetic study shows how public NIH databases can improve ways to assess the risk of cancer.

Insights into the Hormonal Regulation of Promoter Elements the ichnoviriform Associated with Campoletis sonorensis has which Ensures Successful Parasitism of Endoparasitoid Host.

Kayla Parker

Mentored by: Torrence Gill

Chowan University

Campoletis sonorensis requires the utilization of the polydnaviriform associated with its genome to successfully parasitize their Lepidopteran host. To follow up with future experiments, utilization of the luciferase reporter system which is costly for small labs, is being switched to a GFP based system. Within Campoletis sonorensis ichnoviriform, a well studied gene family (cys-motif) is targeted for this study because of their elevated expression during parasitism however their promoter elements exist within the viriform in different equimolar ratios which suggest some more active promoters. We have subcloned 1000 bp promoter fragments for all 10 cys-motif genes (VHv1.1, VHv1.4, WHv1.0, WHv1.6, A'Hv0.8, AHv1.0, UHv0.8, UHv0.8a, LHv2.8, and FHv1.4) into the pGL3-basic-EGFP vector. We utilized bioinformatics to assess Ecdysone Response (EcRE) and Juvenile Hormone Response element (JHRE) binding sites which are strong indicators of regulations. The plasmids were tested for viability to confirm the expression of EGFP, which is going to be the basis of future experiments.

The Digital News Cycle: Opportunities and Challenges in Production, Distribution, and Consumption

Sophie Parker

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This research explores how the rapid evolution of digital media is transforming the production, distribution, and consumption of news, creating both new opportunities and challenges for modern society. Utilizing a comprehensive review of contemporary media trends and technological developments, this project investigates how social media, artificial intelligence, and digital platforms have reshaped the news landscape. The findings indicate that while decentralized production, real-time reporting, and multimedia storytelling have expanded public access and informational speed, they have also introduced significant challenges. Algorithm-driven distribution and active user participation have contributed to filter bubbles, echo chambers, shortened attention spans, and the rapid spread of misinformation amplified by AI. Consequently, these developments have fostered declining public trust in institutional credibility. The conclusion emphasizes that the future of journalism depends on society's collective ability to leverage technological benefits while safeguarding essential democratic values. This research contributes to the broader academic dialogue by underscoring the vital need to promote media literacy and uphold ethical journalistic standards as digital media continues to evolve.

The Feelings of Food Security: A Comparison of Self-view Between Food-insecure and Non-food-insecure Populations

Emily Parris

Mentored by: Jen Blush

William Peace University

Food security is a fundamental physiological need recognized by the field of psychology to form the basis of esteem and self-actualization. The ability to perform effectively in key contributory roles in society (namely student and employee) rely on this strong foundational hierarchy. Existing research suggests that at least one in ten households since 2010 has been food insecure with a growth of .7% between 2022 and 2023. We hypothesize that food insecurity will have a significant effect on both students' and non-student adults' self-perception; that findings will demonstrate decreased self-worth, higher rates of burnout, and decreased self-efficacy. Results ($N = 86$) show significant Pearson correlations ($p < .05$) between food insecurity and self-worth indicating that as self-worth increases participants are more likely to be food secure. Contrary to our hypothesis and preliminary results, overall burnout and all four of its subsets (exhaustion, mental distance, cognitive impairment, emotional impairment) were not found to be significant. Notably self-efficacy's correlation to food security was also not found to be significant. Protective factors and alternative explanations will be further discussed in the presentation. Together, these findings support both a) the idea that non-clinical aspects of poor mental health amongst students may be mediated by addressing resource insecurities (namely food) and b) when considering issues that affect student success, food security is also a factor.

The Orphan Train Movement: Emigration as a Cure for Pauperism

Udaya Sri Parthiban, Rasya Kolakaleti, Princess Piamah-Assin

Mentored by: Chad Philips

Guilford College

From 1854, the Children's Aid Society, led by Charles Loring Brace, and later other institutions relocated over 300,000 children from New York City to rural homes over 75 years. Previous research suggests the movement as charity or as part of child labor history, leaving its effect on foster care and adoption underexamined. This study asks how criticism of the movement shaped child welfare reform. We analyzed primary sources (Children's Aid Society reports, police records, newspapers, state laws, Children's Bureau archives) and secondary scholarship, documentaries, and an interview with a rider's grandson. Rushed placements, weak follow-up, separated siblings, auction-style selection, and the Arizona Incident exposed failures in oversight and drew criticism from states, abolitionists, and the public. In response, states adopted guardianship requirements, bonds, and licensing, and the federal Children's Bureau was founded in 1912, prioritizing family preservation, keeping siblings together, cultural background in placement, and detailed records. We conclude that the movement's failures laid the groundwork for modern foster care, and its legacy persists in weak farm child labor protections and ongoing foster care problems. This history is underrepresented and shows why children's voices matter in child welfare policy.

Does Warning Format Affect Phishing Detection? A Hybrid Risk-Scoring System and Controlled Human Factors Study

Arjun Patel

Mentored by: Collyn Gaffney

North Carolina School of Science and Mathematics

Phishing attacks account for 36 percent of all data breaches and cost an estimated 3.5 billion dollars annually, yet current browser security warnings remain binary: a generic red screen with no explanation of why a link is dangerous. Prior research has focused almost exclusively on improving detection accuracy, leaving a critical gap: no published study has directly tested whether the format of a phishing warning affects how users respond to it. This project addresses that gap through two complementary contributions. First, a three-layer phishing risk scoring system was developed that analyzes any URL using 15 signals spanning URL string features, live DNS record lookups, and VirusTotal vendor consensus across 70 security engines. Signal weights were derived by normalizing Random Forest feature importance scores trained on the PhiUSIIL dataset of 235,795 URLs, producing an interpretable 0 to 100 risk score. A large language model then generates a plain-language explanation of why the URL is or is not suspicious, calibrated to the severity of the verdict. Second, a controlled between-subjects experiment was designed to test whether warning format affects user reporting behavior. Participants are randomly assigned to one of four conditions: a binary message only, a message with a numeric risk score, a message with a plain-language explanation, or a message with both. For 12 URLs spanning verified phishing, ambiguous, and legitimate categories, participants rate their likelihood of reporting the link on a five-point Likert scale. Statistical analysis will determine whether richer warning formats improve discrimination between phishing and legitimate links.

North Carolina Medicaid Dental Reimbursement Rates for Children Ages 0-20: A Comparative Analysis Across Nine States

Aaryan Patel

Mentored by: Caroline Sawicki

University of North Carolina at Chapel Hill

Abstract Background: North Carolina has not substantively adjusted its Medicaid dental reimbursement rates since 2008, reimbursing providers at roughly 34 cents per dollar. Medicaid expansion in December 2023 extended coverage to over 700,000 additional residents, widening the gap between dental service demand and provider participation. This study compares North Carolina's pediatric Medicaid dental rates for children ages 0 to 20 against eight comparable states.Methods: We conducted a secondary data analysis of state Medicaid fee schedules for children, drawn from the American Dental Association's Medicaid Fee Schedules resource. Nine states were compared across nine CDT service categories: Diagnostic, Preventive, Restorative, Endodontic, Periodontic, Prosthodontic, Oral and Maxillofacial Surgery, Orthodontic, and Adjunctive General Services. States were ranked within each category by composite average reimbursement rate. Results: North Carolina ranked in the lower half of comparator states in eight of nine categories. Its weakest performance was in Preventive and Endodontic (9th of 9). Its overall average ranking was 7.00 out of 9. Limitations: This analysis is limited to published fee-for-service schedules and does not account for managed care arrangements, supplemental payments, or cost-of-living differences. Provider participation rates and patient outcomes were also not examined. Conclusion: North Carolina's Medicaid dental reimbursement rates for children rank among the lowest in this comparable group across nearly every category, reflecting sustained underinvestment that limits provider participation and access to care. North Carolina policymakers should prioritize dental reimbursement reform and establish a rate floor with statutory review tied to the Dental Consumer Price Index.

Physics Guided Deep Learning for Indoor Airborne Contaminant Prediction Using Digital Twin Simulations

Smit Patel

Mentored by: Yao Li

University of North Carolina at Charlotte

Airborne contaminants and infectious aerosols pose significant challenges to indoor environmental safety and human health. Computational Fluid Dynamics (CFD) simulations provide detailed representations of indoor airflow patterns and contaminant transport, however, their high computational cost limits their application in rapid exposure prediction and risk assessment. This research proposes a physics-guided deep learning surrogate framework to efficiently predict the spatiotemporal distribution of airborne contaminants in indoor environments, using a digital twin of the McEniry Hall building at the University of North Carolina at Charlotte as a case study. The proposed approach will leverage CFD-generated data representing airflow dynamics, ventilation configurations, human-generated contaminant emissions, and contaminant transport processes to develop a neural network surrogate that is capable of approximating high-precision CFD simulations at a reduced computational cost. Unlike purely data-driven approaches, the model will incorporate physical principles, such as conservation laws and contaminant transport equations, into the learning process. These physics-based constraints could help the framework aim to improve prediction accuracy, reduce dependence on extensive training datasets, and enhance generalizability across varying indoor environmental and ventilation conditions. The proposed framework will be systematically evaluated on its ability to predict contaminant concentration fields, using metrics such as prediction accuracy, data efficiency and adherence to physical constraints. The broader objective is to support rapid identification of areas with elevated airborne contaminant exposure, providing a foundation for efficient, physics-informed assessment of infectious aerosol transmission and airborne toxic hazards in complex indoor environments.

State and Federal Education Policies Affecting Immigrant Inclusion in Charlotte's Early Childhood Education Workforce

Sonika Pattila

Mentored by: Stephanie Potochnick

University of North Carolina at Charlotte

Immigrant educators are an important part of the early childhood education (ECE) workforce, especially in communities with growing immigrant populations. However, state and federal policies can affect the opportunities available to immigrant workers in the ECE workforce. This project is a sub-project of a larger study examining Charlotte's multilingual ECE workforce training programs. For this sub-project, I will review and compare federal policies with North Carolina state policies and local policies in Mecklenburg County that affect immigrant participation in the ECE workforce. Previous research shows that immigrant workers make up a significant part of the child care workforce and that immigration policies can affect both workers and the families who depend on early childhood programs. Local research also shows that Charlotte Bilingual Preschool has created pathways for Latino parents to become bilingual ECE educators, while lower preschool enrollment among Latino children in Mecklenburg County may be connected to limited trust and connections with the early childhood system. I will examine how policies at each level may create barriers or support opportunities for immigrant educators to enter, remain in, and advance within the workforce. Expected results will identify policy differences and areas where policies may better support immigrant inclusion and economic mobility. This research is important because understanding policies at different levels can help identify opportunities to strengthen the ECE workforce and better serve immigrant families.

Least but not Last: The Influence of a Naturalistic Environment across Least Killifish Lifestages

Sydney Paust

Mentored by: Rebecca Hale

University of North Carolina at Asheville

The history of fishkeeping is a rich one, dating back to the Roman empire and expanding into modern day. Over the years, the practice has changed greatly, beginning as an exclusively wealthy naturalists' hobby before becoming more widely accessible. Today, fish are one of the most popular pets in the world, with an estimated 1 billion ornamental fish being sold worldwide every year. Notably, they are also one of the most mistreated animals in the pet trade, having incredibly high rates of mortality and very rarely being seen by veterinarians. This study explores one element of the hobbyist aquarium trade that may contribute to these high mortality rates: use of synthetic habitat materials. While easy to clean and maintain, synthetic materials lack bioactivity and may impact the chemical balance of the aquarium system, leaking microplastics into the water. Further, animals may interact with live and synthetic materials differently, in ways that are not always visible, but which may affect growth and reproduction. In this study, I compare growth, survival, behavior, and reproductive rates of fish housed in a Synthetic environment (one containing exclusively plastic/resin structures) versus in a Naturalistic one (one containing exclusively organic structures). I focus on wildcaught Least Killifish, Heterandria formosa, a common aquarium fish and livebearing species native to the southeast US. This species is ideal because lab rearing protocols are well established and their unique life histories lend themselves to measuring subtle effects on reproduction. Here, I present early results from this project.

Differences in the Epigenetic Landscape of Diffuse Large B-Cell Lymphoma (DLBCL) and Hodgkins Lymphoma (HL) as Compared to Healthy Immune Cells

Theodore Pawlik

Mentored by: Andrea Perreault

Elon University

Cancer is a disease characterized by the uncontrolled growth of cells caused by improper gene expression. Lymphoma is a type of cancer involving the lymphatic system. Lymphoma affects young and old people alike, and subtypes like Diffuse Large B-Cell Lymphoma (DLBCL) and Classic Hodgkins Lymphoma (cHL) have high rates of remittance and resistance. Advances in the field of genomics have changed the way we understand cancer. By looking at epigenetics, methods of regulating gene expression without altering the DNA sequence, researchers are beginning to piece together a more comprehensive understanding of the mechanisms by which cancer develops. This bioinformatics-based project aims to answer the question "How do epigenetic mechanisms differ between healthy cells and those affected by DLBCL and cHL?", by using publicly available next-generation sequencing data. Specifically, we analyzed ATAC-seq data, which provides information about chromatin accessibility, a key determinant of gene expression. This data was downloaded, screened for quality, and processed to determine regions of accessible chromatin. Differential analysis was conducted, and comparisons were drawn between different disease states. Analysis is still ongoing, however, we expect to identify differentially accessible promoter or enhancer regions that may contribute to the shift from healthy cells into disease subtypes due to changes in gene expression. In the future, this chromatin accessibility data will be integrated with gene expression and histone modification data to create a more wholistic perspective on epigenomic differences between disease subtypes. These results could be used to create precision treatments and discover biomarkers that can predict prognosis.

Testing induced resistance in Pleurotus djamor mycelium following exposure to live and UV-killed Bacillus subtilis

Stella Payne

Mentored by: Marguerite Bishop

Gaston College

Mushroom cultivation has become an increasingly popular hobby among amateur mycologists, homesteaders, and farmers, and Pleurotus djamor, known commonly as the pink oyster mushroom, is a frequent choice for beginners. Regardless of setting or experience, every cultivator must contend with contamination, and the most common defense available is simply growing mycelium fast enough to outcompete other microbial life. However, recent transcriptomic work by (Beijen et al., 2024) suggests that cultivators may have another option. This experiment asks whether exposing Pleurotus djamor mycelium to bacterial contamination elicits a defense response that persists in tissue subsequently isolated from the contaminated culture. Three groups will be established: an uncontaminated control, a group exposed to live Bacillus subtilis, and a group exposed to UV-killed Bacillus subtilis. Uncontaminated mycelium will be recovered from all three groups and then challenged with live Bacillus subtilis, with resistance measured as percentage inhibition of radial growth relative to unchallenged plates. Because peptidoglycan and lipoteichoic acid intact in UV-killed cells, it is hypothesized that both previously exposed groups will show lower percentage inhibition of growth than the control and will not differ meaningfully from one another. If both exposed groups perform similarly and outperform the control, this would indicate that recognition of bacterial cell-wall components alone is sufficient to prime a response; no difference among groups would fail to support durable induced resistance under these conditions. Should resistance to contamination prove inducible, it could inform improved cultivation techniques for mushroom growers.

Evaluating the Effects of Shoreline Stabilization on Turbidity and Underwater Light Availability

Cadence Pendergrass

Mentored by: Rachel Gittman

East Carolina University

Coastal ecosystems along North Carolina's coast serve as critical habitats for fish and crustaceans and improve water quality. One method of restoration designed to protect and restore ecosystems is called a "living shoreline", which includes the placement of breakwater structures seaward of salt marsh habitat in the intertidal zone to prevent erosion and support recruitment of oysters. Research has showed that these "oyster breakwaters" can support oyster populations and stabilize marshes. Water clarity is important because seagrasses rely on access to sunlight underwater for photosynthesis. The purpose of my proposed research is to evaluate how the oyster breakwaters can influence local water clarity, measured as turbidity and underwater light availability. I hypothesize that 1) water clarity will be greater seaward than landward of oyster breakwaters, measured as lower turbidity and higher underwater light availability, and 2) water clarity and seagrass productivity will be greater in seagrass meadows adjacent to oyster breakwaters when compared to seagrass meadows that are adjacent to un-stabilized, eroding salt marsh. I am collected water samples for turbidity measurements along 20-meter shore-perpendicular transects from landward to seaward of the three oyster breakwaters and along salt marsh shoreline with no breakwaters. Underwater light availability is measured using HOBO pendant light sensors. If my hypotheses are supported, results will show that oyster breakwaters reduce turbidity and increase the underwater light availability and that these changes in water clarity improve conditions for seagrass growth. The findings of my research could inform future living shoreline design and strategies to protect seagrass.

Benchmarking Vision- Language Models for Augmented Reality Content Realism

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Mentored by: Elias Rotondo

North Carolina School of Science and Mathematics

As augmented reality (AR) becomes more prominent and enters everyday situations, virtual objects in AR content sometimes seem out of place. Assessing how natural AR content seems to users is important for improving AR content realism and immersion, but current evaluation methods rely heavily on user studies, which are time-consuming and harder to implement at a scaled level. This work investigates how vision-language models (VLMs) can serve as reliable evaluators of AR content quality across features that influence realism and immersion. To do so, we introduce RateAR, a dataset of AR images and videos captured across various environments and real-life scenarios. Using this benchmark, we analyze how different VLMs perform on quality factors such as placement plausibility, size appropriateness, and shadow realism in comparison to baselines fine-tuned on RateAR subsets. Our results show that VLM predictions align closely with human ratings, with Spearman rank-order correlations of up to 0.8856. Additionally, our results suggest that VLMs use context clues to determine realism in AR content and that VLMs make inferences based on inputs and not by pattern-matching. Overall, these findings suggest that VLMs can be used as a viable alternative to user studies for assessing AR quality at a large scale.

Rethinking Food Access: Communication, Space, and Inequality in Food Assistance Systems in North Carolina.

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Mentored by: Ian Binns

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Food insecurity is a complex social issue shaped by economic instability, public policy, geography, and social inequality. How food assistance systems are structured, located, and communicated may also influence who can access available resources and who may be unintentionally excluded. This literature review examines the question: How do the structural design, geographic location, and communication practices of soup kitchens and food pantries in North Carolina influence who can access their services and who may be unintentionally excluded? Through a review of research on food insecurity, economic instability, public policy, geographic access, communication, stigma, and community-based food assistance, this study identifies four central themes: the structural causes of food insecurity, the role of geographic and operational design, the effects of communication and stigma, and the potential of decentralized community-based alternatives. The literature demonstrates that barriers such as transportation, limited operating hours, stigma, and centralized food assistance locations can affect whether individuals are able to access available resources. Community-based approaches, such as Josie's Blessing in a Box and givebacknc.org, demonstrate how decentralized resources may bring food and other necessities closer to the communities they serve. However, these approaches do not address the broader economic and policy conditions that contribute to food insecurity. This literature review contributes to conversations about food access in North Carolina by demonstrating the importance of examining not only whether food resources exist, but also how those resources are structured, communicated, and located. These findings may be useful to community organizations, food assistance providers, and researchers interested in developing more accessible and equitable approaches to addressing food insecurity.

Mitigating Musculoskeletal Fatigue in Interventionists: An Electromyography Analysis of the GLiFT Device

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Mentored by: Michel Heijnen

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Surgeons and medical professionals frequently wear heavy lead aprons that induce significant musculoskeletal fatigue and pain, particularly in the shoulders and lower back. This preliminary study evaluated whether a load-transferring exoskeleton device (GLiFT) reduces upper body muscle activation during simulated surgical tasks. Six participants were fitted with protective lead and performed tasks under two device conditions (GLiFT versus no GLiFT) and two structural configurations (back panel attached versus removed). Participants completed randomly assigned trials mimicking surgical demands: close-proximity typing, far-proximity typing, and multi-planar puzzle solving. Electromyography root mean square values were recorded for ten back and shoulder muscles. Preliminary paired analyses indicated that the GLiFT did not universally reduce muscular demand. However, the device produced large, localized reductions in middle deltoid and trapezius activation (Cohen effect sizes exceeding 0.8) when the back panel was attached during far typing and multi-planar puzzle tasks. Conversely, configurations without the back panel, or those involving close-proximity typing, frequently increased compensatory activation across the trunk and shoulders. Due to the limited preliminary sample size, these observed differences did not reach statistical significance. These initial findings suggest that while exoskeletons can offer targeted mechanical relief for extended reach and dynamic movements, task-specific configurations are critical. Optimizing these parameters could play a vital role in mitigating occupational injury risks and extending career longevity for medical interventionalists.

Molecular and Cellular Consequences of OPRM1 Depletion in SH-SY5Y Neuronal Cells

Sade Peterson

Mentored by: Tomilowo Abijo

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Understanding the molecular pathways underlying opioid use disorder (OUD) is crucial because the opioid epidemic remains a significant public health concern. The mu-opioid receptor (MOR), a G-protein-coupled receptor that regulates dopamine signaling and reward pathways while mediating the effects of endogenous and exogenous opioids, is encoded by the OPRM1 gene. Using CRISPR-Cas9 gene editing, this study examined the molecular and cellular effects of OPRM1 knockdown in SH-SY5Y neuronal cells. PX330 MCherry-sgRNA plasmids targeting OPRM1 were transfected into SH-SY5Y cells, with MCherry fluorescence indicating successful transfection. Reverse transcription quantitative polymerase chain reaction (RT-qPCR) was used to measure gene expression, and the MTT assay was used to assess cell viability at 24 and 72 hours following OPRM1 knockdown. OPRM1 knockdown was confirmed by a reduction in OPRM1 expression to approximately 16% of control levels. DRD2 expression was significantly reduced compared with control cells ($p < 0.05$), while OPRM1 knockdown had no significant effect on cell viability. These results suggest that OPRM1 depletion disrupts dopamine-related signaling without immediately affecting neuronal cell viability. This study provides insight into molecular changes associated with OUD and establishes a cellular model for investigating opioid receptor function. Future research will examine additional signaling pathways and the long-term effects of OPRM1 depletion on neuronal cells.

Sociotechnical Interventions for Dementia Caregivers: Perspectives from Caregiving Manuals and Social Media

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Mentored by: Matin Yarmand

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Informal caregivers of people living with Alzheimer's disease and related dementias (ADRD) have many knowledge-based needs, which include the information and skills required to provide care, such as understanding disease progression, managing symptoms, and finding support services. Guidance for meeting these needs typically comes from two perspectives - Caregiving manuals, written by clinicians and health organizations, offer professional guidance, while social media communities serve as sharing spaces for caregivers, by caregivers. Both describe sociotechnical interventions, tools and practices that combine technology with social support, such as mobile apps, online support groups, and care coordination services. Prior work has examined caregiver needs in online communities and evaluated caregiver education materials. Building on this work, we investigate what sociotechnical interventions in social media content and caregiving manuals address the knowledge-based needs of informal ADRD caregivers. Using topic modeling, a computational text analysis method, we identify the main themes in each source and the interventions they describe. We then synthesize and aggregate these interventions into a catalog organized by the knowledge-based needs they address. By drawing on both professional guidance and caregivers' own experiences, this work aims to show what support is currently available to ADRD caregivers and to inform the design of future caregiving manuals and sociotechnical interventions.

The Political Behavior of Recreation Areas: Political Participation in Wrightsville Beach

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This independent research study is part of a larger collaboration involving faculty advisors and peer undergraduate students exploring how leisure may compete with civic engagement for time and energy. The research posits that is that immersive exposure to leisure through attention, lifestyle, and upbringing in a concentrated area may displace attention from politics, thus reducing political participation such as voter turnout and civic participation. The broader research project analyzes turnout at a county-level in ski, lake, and beach communities. Early results analyzing voter participation in county level ski communities found that residents are actively engaged, voting at substantially higher levels than their fellow citizens in other counties. This raises the question of whether, when analyzing leisure-focused communities, a smaller-scale level of observation and analysis might be more appropriate. This study examines whether the Wrightsville Beach voting precinct shows a decline in voting from general to primary elections in comparison to precincts in Wilmington, Porters Neck, and Castle Hayne, in New Hanover County, North Carolina. The hypothesis is that residents who are immersed in a recreation-centered community will show a decline in participation. Public voter turnout databases for the 2022 and 2024 elections to will be used to compare voter turnout in a beach community with turnout levels in surrounding areas. The results will better help us understand how leisure shapes civic engagement.

Identifying Strategies for Preventing Officer-Involved Homicides of Teens in the United States

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This study examined officer-involved homicides of youth ages 13 to 17 that occurred between 2017 and 2023 to determine the circumstances under which the deaths occurred and whether existing police policies and practices, if followed, might have avoided the lethal outcome. The study employed a case study approach, comparing incidents across 21 variables. The current study expands upon Jones-Brown et al (2020), by incorporating a prevention-oriented perspective that matches data from individual case studies to existing police policies, procedures, and training protocols. Twenty-one cases that fit the target age- range and time-period were randomly extracted from The Washington post Fatal Force Database. Case narratives were constructed from multiple publicly available sources, including media accounts, incident reports, court records, and social media. Qualitative contextual comparisons of the case study data to existing police policies and practices identified four potential areas of intervention: adoption and enforcement of policies against shooting into cars, adoption and enforcement of policies against vehicle pursuits; better utilization of Crisis Intervention Teams (CITs); improved utilization of de-escalation techniques when officers encounter minors who are armed. This study contributes to a growing body of literature on improving child well-being and limiting police use of force.

"I think I can, I think I can": Daily Perceptions of Control Over Memory and Memory Failures

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Mentored by: Shevaun Neupert

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Control beliefs are the extent to which one believes they can achieve their goals or exert power over outcomes in their lives (Heckhausen, 2003). Control beliefs tend to be positively associated with cognition, but both can decline with age. Daily memory failures are defined as cognitive errors that individuals may notice in their everyday routines (Sunderland et al., 1983) and can fluctuate on a daily basis. The purpose of this study was to investigate how perceived control over one's memory may be related to memory failures in older adults. The Mindfulness and Anticipatory Coping Everyday (MACE) study, an online 8-day daily diary study, investigated the within-person relationship between daily control beliefs regarding memory and daily memory failures in 117 older adults (aged 60-90). Even after controlling for daily exposure to stressors, neuroticism, and education, results showed that on days when perceived memory control increases, the number of daily memory failures decreases. This highlights the impact of control over parts of everyday life including cognition in older adults.

Enzymatic Impacts on Sweetness and Preferences of Sweetpotato Milk

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Mentored by: Brett Taubman and Daniel Parker

Appalachian State University

Rising rates of lactose intolerance, allergen sensitivity, and concern over the environmental cost of dairy farming have increased demand for low-allergen, nutrient-dense, and environmentally sustainable plant-based milk alternatives. Sweetpotatoes (Ipomoea batatas) combine high nutritional value with a low environmental footprint, making them a promising base for such an alternative. This study examined the effects of α-amylase and glucoamylase treatments on starch hydrolysis to develop a naturally sweetened sweetpotato milk with the goal of producing a naturally sweetened, palatable milk without added sugars. Puree samples were treated with one of the two enzymes, incubated at 60–62°C for a range of durations, and then heated above 80°C to inactivate the enzyme. Sugar concentration was quantified using an enzymatic assay and ultraviolet-visible (UV-Vis) spectrophotometry. Starch breakdown increased sharply after 5 minutes of incubation for both enzymes, with glucoamylase-treated samples consistently reaching higher sugar concentrations than α-amylase-treated samples. Three triangle taste tests and one preference test, conducted with 14 panelists, assessed whether these differences were perceptible and how they influenced consumer preference. Panelists generally distinguished between samples treated with different enzymes or incubation times; however, 11 of the 14 panelists demonstrated a greater preference for the milk treated with α-amylase compared to that treated with glucoamylase, despite its lower sugar concentration. These results suggest that glucoamylase is more efficient at starch hydrolysis, while α-amylase may better align with consumer preferences. Together, these findings can inform future work on optimizing enzyme selection for both production efficiency and palatability in sweetpotato milk.

INVESTIGATING THE POTENTIAL OF 3-MA IN DECREASING PANCREATIC CANCER PROLIFERATION & CHEMORESISTANCE

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Mentored by: Aneesha Dasgupta

University of North Carolina at Charlotte

Pancreatic cancer is the 3rd leading cause of cancer-related deaths in the United States. This is mostly due to late diagnosis and resistance to conventional therapy. Although understanding of the disease has increased in the past decade, investigating novel targets or therapeutic avenues may move the needle towards better survival of pancreatic cancer patients. Previously, our lab demonstrated that 3-Methyladenine (3-MA), a known autophagy inhibitor, decreases proliferation in pancreatic cancer cells (T3-KPC and T4-KPC). However, we did not find autophagy markers to be altered in pancreatic cancer cell lines treated with 3-MA. Although 3-MA has been shown to decrease proliferation in pancreatic cancer cells, the mechanism is unknown. One potential mechanism is ferroptosis, an iron-dependent form of cell death driven by the accumulation of lipid peroxides that damage the cell's phospholipid bilayer, along with oxidative stress. To test this hypothesis, we would measure lipid peroxidation markers, such as lipoxygenase 5 and lipoxygenase 15, and 4-HNE in a human pancreatic cancer cell line (MIAPaCa) and two mouse cell lines (T3-KPC and T4-KPC) treated with different concentrations of 3-MA. Therefore, this study will investigate whether the 3-MA-induced decrease in pancreatic cancer cell proliferation is associated with autophagy-independent cell death. Additionally, this study will examine whether 3-MA sensitizes gemcitabine-resistant cell lines to gemcitabine, the standard-of-care chemotherapy drug for pancreatic cancer. To test whether 3-MA improves gemcitabine efficacy, we will use both combination therapy and pretreatment. These findings will shed light on novel pathways that can be exploited to treat pancreatic cancer.

Title: Navigating GLP-1 Conversations: Social Media Perspectives on Postpartum Health

Anusri Poreddy

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University of North Carolina at Charlotte

The growing popularity of glucagon-like peptide-1 (GLP-1) receptor agonists for weight management has sparked widespread controversy and discussion on social media, including among postpartum and breastfeeding mothers. TikTok is a platform where advertisers, breastfeeding/postpartum mothers, and professionals share personal experiences, peer advice, and/or health-related information. Yet, the nature and quality of content surrounding GLP-1 use remain unclear. This study aims to investigate how GLP-1 medications are discussed on TikTok in the context of postpartum recovery and breastfeeding.We collected TikToks using relevant search terms and hashtags related to GLP-1 use, postpartum health, and breastfeeding. We gathered content from a variety of perspectives, including healthcare professionals, mothers sharing personal experiences, individuals seeking advice, and creators promoting GLP-1-related products or services. We organized videos by content type, creator perspective, primary message, and engagement metrics such as views, likes, comments, and shares.Preliminary observations suggest that TikTok content presents a wide range of viewpoints, including discussions of postpartum weight loss, medication safety, breastfeeding concerns, personal success stories, and recommendations from both medical and non-medical sources. The study seeks to identify common themes and messages while exploring how audiences engage with and interpret the information. Findings from this research may improve understanding of the social media landscape surrounding GLP-1 use and help inform future discussions about disseminating health information to postpartum and breastfeeding individuals.

From Hormone to Drug: Understanding GLP-1

Violet Porterfield

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North Carolina School of Science and Mathematics

Endogenous GLP-1 is a natural hormone found in the human body that stimulates insulin secretion, inhibits glucagon secretion, slows digestion, and signals reward pathways in the brain. These actions promote satiety, help regulate blood sugar, and, in turn, cause weight loss. However, these effects do not last for very long, as the half-life of endogenous GLP-1 is too short and the hormone itself is too unstable. GLP-1 receptor agonists (GLP-1 RAs) are the engineered GLP-1 molecules designed to combat these problems. This research compares endogenous GLP-1 to GLP-1 RAs by reviewing published lab reports and studies on how GLP-1 RAs better mimic the effects of endogenous GLP-1, potential health effects of GLP-1 RAs, and the remaining gaps in our knowledge. As the use of weight loss drugs becomes increasingly common, it's important to understand the biological processes behind their effects. By modifying GLP-1 molecules with fatty acids and other structural changes, scientists were able to increase their resistance to rapid degradation by the DPP-4 enzyme, extending their half-life from minutes to much longer periods. This allowed for more sustained effects on satiety, metabolic signaling, and blood sugar regulation. Although GLP-1 RAs have demonstrated benefits such as weight loss and, in certain high-risk populations, a reduction in major adverse cardiovascular events (MACE), many of their broader effects, such as potential effects on addiction, cancer, and compulsive behaviors, are still being studied.

Combining Boundary Scores with ModelGuard-S for Targeted Defense Against Model Extraction Attacks

Cayman Powell

Mentored by: Liyue Fan

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Machine-learning models offered through online services can be copied through model extraction attacks, in which an attacker sends inputs to a protected model and uses its answers to train a substitute model. State-of-the-art defense method, ModelGuard-S, changes the model's output probabilities while preserving its predicted class. A boundary score measures how close a query is to competing class decisions, helping identify queries that may be more vulnerable to extraction. This work aims to identify whether boundary scores can focus ModelGuard-S on the most vulnerable queries, maintaining strong protection while reducing computational cost. Specifically, we reproduced two query methods, KnockoffNet and JBDA-TR, using CIFAR-10 and Caltech-256 image-classification models with 50,000 queries per experiment. Initial experiments showed that applying ModelGuard-S to every query lowers the accuracy of stolen models. For example, accuracy decreased from 66.16 to 59.43 percent for CIFAR-10 with JBDA-TR and from 63.03 to 43.75 percent for Caltech-256 with JBDA-TR. However, the computation cost for defending every query may be high; in the reproduced results, full-defense time increased by 117 seconds for Caltech-256 with JBDA-TR, from 10,956 to 11,073 seconds. We plan to apply the defense only to the highest-scoring queries in boundary scores and compare stolen-model accuracy, fidelity, and time saving across various boundary score levels.

Catalytic Alkylation of Lignin-Derived Phenolics with 5-Hydroxymethylfurfural for SAF Intermediate Production Using Modified ZSM-5s

Aanya Prashanth

Mentored by: Tim Anglin

North Carolina School of Science and Mathematics

The United States consumes 21 billion gallons of jet fuel annually, representing a significant share of the 106 billion-gallon global total. With the commercial jet fuel market projected to increase to over double that amount by 2050, and aviation already responsible for 2.5% of global CO2 emissions, the transition away from petroleum-based aviation fuels has become urgent. Sustainable aviation fuels (SAFs) derived from biomass offer a promising pathway to achieve net-zero carbon aviation, but are currently unfeasible due to high energy costs during production. To be a viable alternative to traditional fuels, these feedstocks require low-energy catalytic conversion through simple reaction schemes. ZSM-5 zeolites are strong candidates for hydrocracking biomass into SAFs due to their high thermal stability and tunable textural and acidic properties, which can optimize selectivity and conversion. In this study, ZSM-5, common zeolite catalyst, was modified through both desilication with NaOH to create mesopores and protonation with NH4Cl to enhance Brønsted acid sites while mitigating coking. Successful synthesis of the desilicated and protonated ZSM-5 was achieved and confirmed using SEM imaging. Production of SAF intermediate by the alkylation of phenols and furan alcohols was achieved under low-energy conditions in the presence of ZSM-5. By discovering an optimal pathway, the ZSM-5 holds significant potential as a low-energy catalyst for SAF production. Future work will explore additional transition metal dopants, like Cesium, and varied biomass feedstock components to further assess catalytic performance.

History of Dreams: Defining, Authorizing, and Liberating Identity through Superstition and Science

Aanya Prashanth

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This essay investigates the history of dream interpretation as a shifting struggle over who has the authority to define the unconscious and, consequently, the identities expressed with it. Tracing dream interpretation from ancient Mesopotamia and Persia through the Hellenistic, Late Antique, medieval, Renaissance, Enlightenment, Romantic, and modern periods, it follows the gradual movement of interpretive authority from divine and religious institutions toward scientific and psychological frameworks. While these systems changed how dreams were understood, they consistently viewed the dream as a body necessary to control. The essay also examines how changing perspectives on dreams shaped representations of sexuality and queer desire. Hellenistic mythology and visual art provided spaces for erotic and fluid expressions of identity, while Christian interpretations of dreams reasserted religious authority over the unconscious. Later, the Scientific Revolution and psychoanalysis transformed dreams into biological and psychological phenomena, with Freud's theories providing a clinical scheme for repressed desire and pathologized homosexuality. The Romantic period and subsequent Surrealist and Automatist movements resisted these limits by reclaiming dreams as spaces of interiority and self-expression. Ultimately, the history of dream interpretation reveals a non linear and complex progression from superstition to science, but a recurring transfer of authority over the unconscious. By examining dreams alongside sexuality, art, religion, and psychology, this essay argues that the persistence of queer desire through the dreamscape reflects the broader history of identity surviving attempts to suppress and categorize it.

Long COVID: An Autoimmune Condition?

Sudarshan Praveen

Mentored by: Eric Anderson

East Carolina University

Long COVID is a major health concern around the world, yet the nature of the condition is still little understood. This study aims to build an understanding of the relationship between the NSP5 protein in SARS-CoV-2 and the imbalance in the VWF-ADAMTS13 axis present in individuals with Long COVID, with this imbalance being responsible for microclots in Long COVID patients. By making use of a Western blot, this study analyzes how the immune system of individuals with Long COVID respond to the proteins that emerge from the interaction between SARS-CoV-2 NSP5 and ADAMTS13, thus considering the possibility that microclots in Long COVID may be caused by an autoimmune response to ADAMTS13 acquired during acute COVID. The study found a lack of immune response to ADAMTS13 in the serum of the Long COVID patients tested, suggesting that the SARS-CoV-2 virus maintains a presence in the bodies of Long COVID patients.

Measuring Proton Dose Using HDV2 Gafchromic Films

Amilia Price

Mentored by: Regina DeWitt

East Carolina University

This project aims to show how to modify HDV2 Gafchromic film to get accurate dosimetry measurements with proton beams in the 2-4 MeV range. HDV2 gafchromic films change color when exposed to ionizing radiation due to a specialized polymer layer and have been successfully used to measure the radiation dose from x-rays in the past. The films are layered such that only one layer is able to react and therefore measure the radiation dosage. Proton radiation, which is used to treat cancer, is measured by its Bragg peak, which, depending on the energy of the beam, can miss the active layer of the film. This leads to the film dose appearing to be much less than the actual dose. In the range of 2-4 MeV there are only a few energies that can be accurately measured; however, if the films are modified with absorbers added before the active layer, we can accurately measure a wider range of energies. For this project, thin layers of other materials, mainly aluminated Mylar and PET, are placed in front of the active layer of the HVD2 film in order to manipulate the Bragg peak to fall inside of the active layer. My project investigates how many and what mix of absorbers are needed at a wide variety of energies. Experiments are carried out using the linear accelerator at ECU.

Benchmarking Edge AI's Performance in Assisting Construction Plan Reading Learning Using Meta AI Glasses

Saniya Pritchett

Mentored by: Gongfan Chen

University of North Carolina at Charlotte

Construction professionals regularly interpret complex drawings and site plans to understand project requirements, identify potential issues, and support decision-making in the field. Many students struggle to read site plans and other architectural drawings throughout their career. Things like understanding the general notes and the ability to understand the meanings of different symbols and verbiage has shown its difficulty with many students. As artificial intelligence (AI) continues to develop, wearable technologies may offer new ways to help construction professionals access and interpret plan information on-site and in the office. This research investigates how AI-enabled wearable technology, specifically Meta smart glasses paired with a wrist-worn control device, can assist with construction plan reading and improve access to project information. The central research question is: How can AI-enabled wearable technology support construction professionals and students in interpreting construction plans and accessing relevant information while working in the field? Tasks will evaluate the technology's ability to identify, interpret, explain, and retrieve information from construction plans through voice - activated technology that is coherent and accessible to the user. Expected results include identifying potential benefits and limitations of using wearable AI for plan reading, including accessibility, efficiency, hands-free information retrieval, and accuracy. This research contributes to the growing field of AI applications in construction by examining how emerging wearable technology can support plan interpretation and field-based decision-making, potentially providing a foundation for future research and practical applications in construction education and industry.

Design of a Mixed-Signal Circuit to Evaluate Audio Degradation from Conversion Limits and Amplifier Distortion

Sylvester Pudelko

Mentored by: Yawo Amengonu

University of North Carolina at Charlotte

Analog-to-digital and digital-to-analog conversion form the backbone of modern multimedia systems. However, improper selection of sampling rates, quantization resolution, and poor filter design can severely degrade audio quality through aliasing, quantization noise, and clipping. Pure analog audio systems face similar challenges, but may also have issues with feedback limits and crossover distortion, specifically in Class AB amplifiers. This research presents a mixed-signal design to isolate, study, and demonstrate these non-ideal conditions. First, LTspice computer simulations will be used to create a Class AB amplifier to model phenomena such as crossover distortion, clipping, and loss in audio from poor filter design. Second, a physical circuit will be constructed using operational amplifiers, analog-to-digital converters, digital-to-analog converters, and a push-pull amplifier. The ultimate goal is to develop a printed circuit board that allows users to route live audio sources and audibly experience common audio degradation issues caused by non-ideal digital and analog conditions. Expected results include quantitative and qualitative verification of how various parameter adjustments impact reproduction quality. The contribution of this research will be a hands-on, educational tool that connects theoretical amplifier and filter design with physical audio hardware behavior, enhancing comprehension for engineering students.

UGV Localization using LeGO-LOAM with ICP Refinement for Path Traversal

Hariom Pughat

Mentored by: Srinivas Akella

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Reliable localization is important for unmanned ground vehicles, especially when the robot starts with an inaccurate estimate of its pose (position and orientation). This project studies an initialization method that uses Iterative Closest Point (ICP) to refine the robot's starting pose by aligning a current LiDAR scan with a previously created point-cloud map. The system is tested on an AgileX Scout Mini running ROS 2 Humble with RoboSense LiDAR sensor. A reference map of the operating area is first generated from LiDAR data using LeGO-LOAM. The robustness of point-to-point and point-to-plane ICP (using the libpointmatcher library) is then tested by intentionally adding pose errors to the initial pose estimate. These offsets are used to measure how inaccurate the starting estimate can be before ICP fails to recover the correct pose. Larger offsets of up to 10 m are also tested to represent the type of coarse pose estimate that could come from GPS. ICP is initialized with a multi-hypothesis search over possible poses and returns an ICP refinement. Localization performance is evaluated using translation error, yaw error, success rate, ambiguity between possible matches, and runtime, with LeGO-LOAM poses used as the reference. Current results show that ICP is reliable only when the initial estimate is already fairly close to the true pose, approximately within 5 m and 5-10° of the correct orientation. The search-based approach improves the usable initialization range and can recover the correct pose from larger errors, although performance becomes less reliable in geometrically repetitive parts of the map and when orientation is unknown. A prior provided pose from LeGO-LOAM also improves both reliability and runtime. After the initial pose is corrected, LeGO-LOAM is used for continuous localization while the robot navigates through the environment. The larger project goal is to use this localization system with graph-based navigation, where shortest paths are generated using Dijkstra's algorithm and the robot can later replan when obstacles block its route.

Antimicrobial Efficacy and Biosafety Profile of Green-Synthesized Mushroom Silver Nanoparticles Against Pathogenic and Commensal Escherichia coli Strains

Jordan Queenie

Mentored by: Akamu Jude Ewunkem

Winston-Salem State University

Antibiotic resistance represents a critical global health crisis, prompting the investigation of novel therapeutic alternatives. Recent research highlights nanoparticles as a promising strategy due to their unique mechanisms of action, which include disrupting bacterial cell membranes, releasing toxic reactive substances, and delivering antimicrobial agents directly to target sites. These multi-targeted approaches significantly inhibit bacterial growth while minimizing the likelihood of bacteria developing further resistance. In a previous study, we successfully synthesized silver nanoparticles (AgNPs) using mushroom extracts, demonstrating their potent antimicrobial efficacy against both Gram-negative and Gram-positive bacteria. Building upon those findings, the current study evaluates the efficacy of these green-synthesized mushroom AgNPs against a panel of pathogenic bacteria isolated from patients with Escherichia coli infections. Additionally, this research investigates the biosafety profile of these nanoparticles by evaluating their impact on beneficial gut microbiota, specifically commensal E. coli strains. Ultimately, the insights gained from this study will provide valuable data for healthcare professionals and researchers seeking viable, biocompatible alternatives to conventional antibiotics in the fight against resistant infections.

Investigating the Relationship Between Olfaction and Alzheimer's Disease

Mariam Raja

Mentored by: Hisayo Tokura-Gallo

Gaston College

This study examines whether individuals with a family history of Alzheimer's disease (AD) exhibit diminished olfactory sensitivity when compared to individuals without a family history of the disease. The study examines whether these individuals have a reduced ability to distinguish between synthetic and natural versions of common odors, such as mint, orange, mango, pine, and lavender. It also evaluates whether individuals with a family history of AD are less sensitive to the subtle olfactory nuances typically observed in community college participants. Participants were presented with both natural and synthetic odor stimuli and asked to identify and distinguish between them. By examining differences in odor perception between the two groups, this study aims to determine whether family history of AD may be associated with early changes in olfactory sensitivity. The findings may support the utility of olfactory testing as a non-invasive, early clinical marker for disease vulnerability, potentially identifying at-risk individuals at an even younger age than previously anticipated.

Effects of Inlet Pressure and Flow Straighteners on Microfluidic Flow Behavior

Anarghyan Raja

Mentored by: Christopher Thaxton

North Carolina School of Science and Mathematics

Microfluidic systems generally operate under laminar flow. However, varying inlet pressures and geometries can result in changes in flow behavior. Understanding this flow behavior is important for achieving consistent device performance. This project investigates how inlet pressure affects flow velocity and whether flow remains laminar or develops turbulent characteristics. We modeled this microchannel using SimScale, a computational fluid dynamics solver. Using two models, laminar and k-omega shear stress transport (turbulent), we simulated different inlet pressures and extracted the average and maximum velocities. Additionally, we investigated microchannels that included flow straighteners (5-layer, 6-layer, and 7-layer). Our simulations generally showed an increase in velocity as we increased our inlet pressure, showing us how inlet pressure affected fluid flow throughout the microchannel. Additionally, as vorticity increased at higher inlet pressures, differences were observed between our two models. For example, for the simulation of a 1000 Pa inlet pressure, the average velocity for the laminar model was 0.4195 m/s, and was 0.3725 m/s for the turbulent model. The addition of flow straighteners also reduced velocities. Overall, our project demonstrates an effect of both inlet pressure and geometry on fluid flow in a simulated microchannel and provides a framework for evaluating flow straighteners.

Blood Pressure Responses Across Repeated Voluntary Breath Holds in Older Adults with Elevated Blood pressure

Lakshanyaa Rajendran Balaji

Mentored by: Joseph Stock

East Carolina University

INTRODUCTION: Previously, our lab demonstrated that a single voluntary apnea causes increases in blood pressure through an increase in sympathetically mediated vasoconstriction. However, clinical populations such as severe obstructive sleep apnea patients can experience 30 or more apneic events per hour. PURPOSE: We aimed to assess if repeated bouts of apnea drove substantial increases in hemodynamic parameters through sympathetically mediated vasoconstriction in older adults. METHODS: Seventeen older adults with high blood pressure (62 ± 6 years) were equipped with a continuous finger cuff to measure beat-to-beat blood pressure. Participants were instructed to hold their breath until the volitional breakpoint following a normal inhalation. They completed 10 breath holds, with a one-minute break between each. Hemodynamic measures were compared at baseline and during the final 10 seconds of the 1st, 5th, and 10th breath holds using repeated-measures ANOVA. RESULTS: Systolic blood pressure significantly increased from baseline to the first, fifth, and tenth apnea (134±15, 148±18, 158±21, 161±26.8 mmHg, $p < 0.001$). Diastolic blood pressure significantly increased from baseline to the first, fifth, and tenth apnea (78±7, 89±12, 93±13, 95±215 mmHg, $p < 0.001$). Total Peripheral Resistance significantly increased from baseline to the first, fifth, and tenth apnea (1.9±1.1, 2.1±1.1, 2.3±1.0, 2.4±1.1 mmHg/L/min, $p < 0.001$)CONCLUSION: From baseline to repeated bouts of apnea appeared to have an additive effect on blood pressure and vascular resistance, and hemodynamic parameters stayed elevated, suggesting increases in sympathetically mediated vasocontraction.

Dynamic Disulfide Exchange in Molecularly Imprinted Polymers for improving sensitivity and batch reproducibility of electrochemical lactate sensors

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Mentored by: David Probst (Affiliated with UNC-Chapel Hill)

North Carolina School of Science and Mathematics

Each year, there are 11 million sepsis related deaths worldwide, most of which are preventable by detecting the condition earlier. The turnaround time for sepsis diagnosis is too long considering how fast it progresses. The current method for lactate detection is through electrochemical modalities, such as the iSTAT via enzymes. While effective, enzymatic methods have limited stability, and relying on sampling blood costs patients critical time for intervention. Research linking changes in blood lactate levels to sweat lactate levels presents an opportunity for monitoring using a molecularly imprinted polymer (MIP). Despite current MIP sensors showing some success, imperfections in the self-polymerization stage of production can lead to misshapen imprints, causing reduced sensor sensitivity. Current methods of ensuring uniformity include electropolymerization and surface imprinting. These methods help with uniformity, but they lack the ability to fix imperfections post-production, due to the rigid structures they form. This study investigates whether incorporating reversible disulfide bonds as a crosslinker into a covalent adaptable network (CAN) on a MIP can allow for post-polymerization restructuring of lactate binding sites. Our proposed MIP would be able to correct imperfections post-polymerization, leading to lower batch variability, while ensuring repeatable specificity/sensitivity of the polymer. The sensitivity of the CAN derived MIP will be evaluated across the physiological window for lactate, and compared against other standard MIPs. The CAN derived MIP will undergo thermal annealing cycles in the presence of lactate, showcasing reusability and improvement in sensitivity. Improved post-annealment performance would prove that CAN crosslinking annealment enhances MIP performance.

Design and Field Evaluation of a Low-Cost Single-Axis Solar Tracker Using Photovoltaic Directional Sensing

Rohan Rajesh

Mentored by: Carlotta Berry

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This study presents the design, fabrication, and field evaluation of a low-cost single-axis solar tracking system intended to quantify the energy gain attributable to tracking alone. A tracking panel (Configuration B), oriented by a servo motor in response to the differential output of paired photovoltaic sensing cells, was compared against a fixed-angle baseline panel (Configuration A). Photovoltaic cells were selected in place of conventional light-dependent resistors so that the sensing and generating elements share the same spectral response. Voltage, current, and power for each configuration were measured with INA219 current sensors and logged to a micro SD card by an Arduino microcontroller. Configuration B recorded 18.8% lower average power than the baseline; however, this result does not constitute evidence regarding tracking performance. Configuration B operated near its open-circuit point for 99.7% of samples, carrying no meaningful electrical load, and the two configurations were tested on separate days rather than simultaneously. The 10% energy gain criterion is therefore reported as not demonstrated. Evaluated independently, the tracking subsystem satisfied its response-time criterion, with a median repositioning interval of 0.5 minutes. The principal technical finding is directional sensor saturation: both analog channels reached the 10-bit converter ceiling simultaneously in 46% of samples, reducing the control differential to zero. In a session exhibiting 99% saturation, no repositioning occurred over 1 hour 38 minutes. Recommendations include sensor signal conditioning, verified load conditions, in-field validity indicators, and a repeated simultaneous trial.

Barriers to Utilizing Mental Health Resources Among Minority Undergraduate Students

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Mentored by: Tyisha Terry

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Mental health concerns have become increasingly common among college students, including depression and anxiety. Although racial and ethnic minority students may experience similar or higher levels of depression and anxiety compared to White students, they are less likely to seek mental health support. Previous research has found stigma, financial concerns, language barriers, cultural beliefs, and limited access to culturally responsive providers as potential barriers to care. This qualitative study asks: What barriers do minority undergraduate students at UNC Charlotte experience when seeking mental health resources, and what strategies may improve their access to culturally responsive support? Data are being collected through semi-structured interviews with approximately 4-6 minority undergraduate students, specifically Asian American, Hispanic/Latinx, and Black students, recruited through social media and cultural organizations, and 2-3 UNC Charlotte mental health support staff recruited through email. Student interviews focus on their experiences with mental health services,help-seeking factors, cultural and family stigma, resource awareness, cultural responsiveness, and structural barriers. Staff perspectives provide institutional insight into service gaps and strategies for improving access. Interviews will be conducted via Zoom and are recorded with participants' consent. Data will be analyzed using thematic analysis. Results are expected to identify barriers and strategies to improve awareness, access, and cultural responsiveness of mental health services. Findings will inform the development of a culturally responsive mental health resource guide for minority students at UNC Charlotte.

Seeing Red: Media Portrayals and Identity Negotiation Among Naturally Redheaded Women

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Mentored by: Karen Lindsey

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While extensive literature addresses how race and gender shape identity and stereotyping, little academic work examines how hair color, specifically red hair, affects social identity or how redheads experience, resist, or embrace these stereotypes across age. Research suggests redheaded women experience stigma differently than women of other hair colors (Weir, 1989). This research aims to answer how naturally redheaded women aged 18-35 perceive and negotiate their redheadedness in everyday life. It also examines which factors contribute to the myths of hypersexuality, temperament, and otherness attached to red hair in film, television, and social media. We anticipate identity negotiation changes with age.Younger women (18-25), particularly those active on social media, may negotiate their redheadedness more actively and older participants (25-35) may describe greater acceptance. A qualitative national survey distributed through redhead-exclusive social media groups, clubs, and organizations assessed self-perception, stereotyping, and identity negotiation, complemented by in-depth interviews. 52 survey responses and 10 interview transcripts are currently being coded in Dedoose to identify themes related to media representation, identity, social experiences, and identity negotiation across age groups. By examining how a visible trait becomes a site of stereotyping and empowerment, this project contributes to feminist media studies, identity research, and strategic communications.We hope to offer insight into why redhead stereotypes persist and how redheaded women navigate these stereotypes as part of their identities.

Developing and Growing Zebrafish for Biological Research

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Mentored by: Isaac Stewart

North Carolina School of Science and Mathematics

This project aims to establish a reliable and reproducible method for breeding zebrafish (Danio rerio) at the North Carolina School of Science and Mathematics (NCSSM). Zebrafish are widely used in biomedical and developmental research because of their rapid reproductive cycle, transparent embryos, and genetic similarity to humans. Although established breeding protocols are described in scientific literature, these procedures must be adapted to the resources available at NCSSM. This study evaluates the effects of fish stocking density, female-to-male mating ratio, photoperiod, environmental conditions, and diet on breeding efficacy. Multiple breeding trials will be conducted under different variables and variable combinations to establish the most optimal parameters for zebrafish breeding and rearing. Embryo production and viability will be recorded to compare the effectiveness and consistency of each experimental condition. By examining and controlling for as many variables as possible this study will identify conditions that promote consistent embryo production and can be reliably maintained in the NCSSM laboratory. The resulting protocol will provide NCSSM student researchers with a standardized, efficient, and cost-effective method for maintaining zebrafish and obtaining embryos despite resource constraints. This project will support future student research in developmental biology, genetics, and biomedical science and expand accessibility to NCSSM's potential for zebrafish-based research.

Racial Representation in Student Government : A Longitudinal Analysis of High School Yearbooks, 2000-2010

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Student government (SG) has been viewed as a key site for civic learning, with prior research linking participation to increased civic engagement later in life. However, existing studies suggest that access to SG is inequitable, with schools serving larger minority populations less likely to have effective student councils. Despite this body of work, no study has directly tracked the racial composition of SG membership over time, leaving a gap in understanding who actually holds these leadership positions. This project addresses that gap by examining the extent to which the racial composition of SG reflects the racial composition of school wide enrollment of high schools across a large, diverse public school district between 2000 and 2010. Using scanned yearbooks, we photo coded the racial composition of SG members and compared it to enrollment data to calculate representation ratios. We also qualitatively analyzed yearbook captions to describe variation in SG portrayal. We found that minority students are significantly underrepresented in SG relative to their enrollment share across most schools. The disparity widens when looking at SG leadership solely. Furthermore, SG's that overrepresented minorities were less empowered, with the converse being true of SG's that overrepresented white students. We produced a dataset of representation ratios by school, year, and racial group and a written analysis. This study provides a novel, visually grounded record of racial representation in student leadership, though findings may be limited by the subjectivity of photo coding, inconsistencies in yearbook documentation, and limited generalizability beyond the district.

Immigrant Integration in the Queen City: Cross-Sector Coalitions and Local Integration Capacity in Charlotte, North Carolina

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Mentored by: Margaret Commins

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This project asks to what extent municipalities rely on cross-sector coalitions to promote and sustain immigrant integration, using Charlotte, North Carolina, as a case study and comparing its institutional approach with other U.S. cities. Existing research shows that the United States lacks a coordinated federal integration policy, leaving municipalities with significant responsibility but limited legal authority, while local integration initiatives often remain vulnerable to leadership change. The project uses a comparative case-study approach that traces the evolution of Charlotte's integration efforts and examines institutional models in peer cities. It also draws on fieldwork conducted as a research assistant in a research-movement collaborative linking International House with UNC Charlotte's Center for Migration and Diaspora Studies and Urban Institute. This work includes participant observation at Charlotte International Cabinet meetings and in Welcoming America's Gateways for Growth program, as well as participation in "Share Your Voice," an arts-based study with children of immigrants. Preliminary findings suggest that nonprofit, university, and community partnerships may have helped sustain parts of Charlotte's integration capacity after the Office of Equity, Mobility, and Immigrant Integration was dismantled in 2024. Although the City's FY 2027 budget funds two international relations positions, Charlotte still lacks a standalone integration office. These positions may represent an institutional opportunity for a more durable model connecting immigrant integration, international relations, and economic development. The project therefore aims to inform whether and how immigrant integration can become a lasting part of Charlotte's new international relations capacity.

Effects of Keratin on Heat Shock Recovery; Protective Properties of Keratin During Oxidative Stress in Human Embryonic Kidney Cells

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Human embryonic kidney cells (HEK293) exposed to stress exhibit toxicity. Protein recycling pathways can mitigate toxicity and promote cellular repair. In this study, we investigated whether activation of these pathways might result from exposure to keratin biomaterials (crude keratin [1mg/mL]). Specifically, we used a GFP–250 transfection system to track protein aggregates in HEK 293 cells exposed to heat shock and a WST1 assay to create a way for measuring stress levels in oxidatively stressed cells. Cells were exposed to varying keratin dosages and exposure durations and stressed with either 0.5mM H2O2 or heat shocked for 90 minutes at 43°C. Aggregate formation in heat shocked cells was tracked using fluorescent microscopy; end point spectroscopy was used to quantify stress levels in oxidatively stressed cells. Our results suggest that cells subjected to longer keratin exposure at a dose of 0.5mg/mL prior to oxidative stress showed higher variation in their stress response compared to the control group. We also found that cell exposure to keratin at doses (≥ 1mg/mL) resulted in reduced stress when compared to the control group with no Keratin. Finally, we observed no impacts of crude keratin on the protein aggregation process in heat shocked HEK cells. These data, however, were difficult to deduce specific meaning from because the control cells did not recover as we expected to see. Future experiments will expand into mechanistic studies that may illuminate why keratin–dosed cells demonstrate different responses to stress.

The Role of Fusion Proteins in the Progression of Pilocytic Astrocytoma to Glioblastoma

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Mentored by: Andrea Perreault

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Pilocytic astrocytoma (PA) is the most prevalent pediatric brain tumor affecting children from the ages of 0-19 years old. Although PA itself is a benign WHO grade 1 tumor, in rare cases it has been shown to progress to a malignant glioblastoma, which is WHO grade 4. Glioblastomas (GBM) have a significantly worse prognosis and are much more difficult to surgically treat, unlike PA which is normally resected early in childhood. This has led to a significant gap in research regarding the molecular mechanism of the progression of PA to GBM. Originating from gene fusion events, fusion proteins have been newly identified as oncogenic drivers in various other types of cancer and show potential in driving the transition from PA and GBM. St. Jude Cloud Genomics Platform (SJCGP) is a database hosted by St. Jude Research Hospital which has de-identified patient sequencing data. CICERO is a software that uses the available SJCGP data to predict structural variations, specifically gene fusions. Fusion events found in PA and GBM samples will then be selected and compared to find similarities between the two cancer types. These specific gene fusions will then be translated into fusion proteins and modeled using predictive software. We expect to find at least one shared fusion event for PA and GBM, which may suggest its role in PA progression. Fusion proteins found to drive this progression to GBM may be used as therapeutic targets in the future as an alternative to surgical resection.

Perimenopause: Advancing Health Literacy, Patient Education, and Reducing Stigma Through Community-Based Education

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Perimenopause is the transitional stage leading to menopause and can begin years before menstrual periods permanently stop. During this time, many individuals experience physical, cognitive, emotional, and sexual changes that can affect quality of life. Despite its prevalence, perimenopause remains poorly understood, and many people enter this stage without adequate education or reliable information. This lack of awareness contributes to misinformation, delayed symptom recognition, stigma, and challenges communicating with healthcare providers. The purpose of this project was to explore a community-based approach to increasing perimenopause awareness and encouraging conversations about this often-overlooked stage of life. In partnership with a local romance bookstore, participants attended an educational workshop on perimenopause and then worked together to create zines that reflected their understanding, personal experiences, and key health messages. The completed zines were qualitatively analyzed to identify common themes, messaging strategies, and participant perspectives. Participants frequently emphasized the importance of recognizing symptoms, seeking accurate health information, advocating for themselves in healthcare settings, and normalizing discussions about aging and sexuality. Many also challenged common misconceptions surrounding perimenopause while encouraging openness, support, and shared learning within their communities. These findings suggest that creative, community-based educational programs can help improve perimenopause health literacy while reducing stigma and fostering more informed conversations about women's health. Increasing awareness of perimenopause may empower individuals to recognize symptoms earlier, seek appropriate care, and make informed decisions throughout the menopausal transition.

Globalization, Beauty Ideals, and Consumer Awareness in the Cosmetic Industry

Tanushri Ravada

Mentored by: Jennifer Stuart

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Beauty products such as makeup, skincare, and hair products are used by millions of people, but many do not fully understand what these products contain or how they may affect their health. Society and the media promote certain beauty standards, which can influence how people see themselves and the products they choose to use. As global beauty industries increasingly promote standardized appearance ideals across cultures, consumers are exposed to marketing messages that shape both purchasing behaviors and perceptions of product safety. However, not much research connects beauty standards directly to how well people understand the products they're using. This literature review investigates how globalization, beauty ideals, marketing practices, and cosmetic industry regulations influence consumer awareness of cosmetic ingredients and health risks. This literature review synthesizes peer-reviewed research published between 2010 and 2026 examining beauty standards, cosmetic marketing, product labeling, ingredient transparency, consumer knowledge, and regulatory policies. The findings show that marketing claims have a stronger influence on consumer decisions than ingredient information itself. Labels such as "clean" and "cruelty-free" can make products seem safer, even when they do not always reflect safety. Research also shows some products may contain harmful substances, including heavy metals, affecting health over time. Despite these risks, people continue to use these products due to social pressure and trust in marketing claims. By connecting research on beauty ideals, globalization, consumer behavior, and cosmetic safety, this review highlights the need for improved ingredient labeling and greater transparency in the beauty industry.

Preservation and Restoration of Coral Reefs

Ilvika Ravat

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North Carolina School of Science and Mathematics

Coral reefs are among the most biodiverse ecosystems on Earth, supporting millions of marine organisms. Growing awareness of the vulnerability of coral reefs in the Maldives to climate change motivated this research into potential conservation strategies. Climate change poses significant threats to coral reefs through coral bleaching, ocean acidification, sea-level rise, increased storm activity, and reduced coral recovery capacity. This research examines the question: What does current research suggest about the potential of coral cryopreservation for the long-term conservation and restoration of coral reefs threatened by climate change? To answer this question, I analyzed and synthesized findings from published scientific literature including studies accessed through the National Library of Medicine and published in journals such as Nature Communications. Previous research, particularly work by Mary Hagedorn, has contributed to advances in coral cryopreservation and the development of coral biobanks, including Taronga's CryoDiversity Bank in Australia. The studies analyzed indicate that advances in cryopreservation, including isochoric vitrification, have enabled researchers to successfully preserve and revive coral biological material and establish coral cell cryobanks. These findings suggest that cryopreservation could help conserve coral genetic diversity and provide biological resources for future reef restoration, with potential relevance to vulnerable coral reef ecosystems such as those in the Maldives. Further research is needed to determine how these techniques can be scaled and applied across coral species and ecosystems.

Predicting immunotherapy use in Lung Adenocarcinoma patients using genomic characteristics

Ishika Ravat

Mentored by: David Kane

North Carolina School of Science and Mathematics

This project explores the possibility of predicting immunotherapy use in Lung Adenocarcinoma patients using genomic characteristics. It examines multiple types of cancer vaccines (such as mRNA vaccines), how they work, when to use them and their respective functions. In order to test the ability for genomic characteristics to predict immunotherapy, I used the data of anonymous lung adenocarcinoma patients from cBioPortal (for cancer genomics). I compare multiple key variables such as a TP53 pathway and TMB. I used R coding to create graphics and plots comparing the data and variables. Finally, I used these graphics to generate conclusions and analyze the data. The emergence of immunotherapy as a cancer treatment requires extensive testing, research and multiple evaluations. In order to test the efficiency and effectiveness of these immunotherapy vaccines, many oncologists use clinical trials. In this project, I also investigate multiple ethical considerations of the testing of these vaccines specifically on those in an especially critical condition.

Optimizing Ascorbic Acid and Tannic Acid Dual-Coated Silver Nanoparticle Synthesis to Inhibit Oxidation and Enhance Antibacterial Effects

Elyse Rea

Mentored by: Tandy Grubbs

North Carolina School of Science and Mathematics

Throughout the globe, antibiotic resistance among bacteria is a growing crisis that threatens the lives of many. This study evaluates Ascorbic Acid and Tannic Acid Dual-Coated Silver Nanoparticles, and the optimization of synthetic conditions that are more likely to yield stable nanoparticles and retain antibacterial activity under clinical conditions. Several batches of ascorbic acid and tannic acid coated silver nanoparticles have been synthesized over a pH range from 7.0 to 10.5. In each case, nanoparticle size and stability has been assessed using UV-Visible spectroscopy, and antibacterial zones of inhibition have been measured against cultured Escherichia coli K-12 strains. Experimentation thus far indicates these nanoparticles are most stable and exhibit maximal antibacterial behavior when synthesized around the pH range of 9-9.5, with a clear declination in stability and antibacterial activity when the synthetic pH goes to the extremes of 7.0 and 10.5. This outcome supports a hypothesis that mildly basic conditions favor more active nanoparticles with lower surface charge and electrostatic repulsion.

Temperature and Volatility in Phase IV EU ETS Carbon Market

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Mentored by: Anindita Das

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This study determines whether extreme temperatures affect the volatility of European Union Allowance (EUA) futures prices during Phase IV of the European Union Emissions Trading System. This paper uses data from the six countries that have the largest emissions in the EU: Germany, France, Italy, Spain, Poland, and the Netherlands. The Generalized Extreme Value (GEV) model was used to show that extreme heat and cold events differed between 2013 and 2025, and the Granger causality tests and the GARCH-X model were used to determine whether the index created in the GEV model can predict changes in EUA futures price volatility. Though results revealed an increase in temperature maxima in France and Spain, and shifts in temperature minima in Italy, the data did not predict EUA futures volatility or improve the GARCH-X model. This extends and supports previous studies regarding the temperature influence on carbon market volatility from Phase III of the European Union Emissions Trading System.

Amplification of 16S via PCR in Two Dragonfly Species

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Mentored by: Sandra Clinton

University of North Carolina at Charlotte

Urbanization can significantly alter freshwater ecosystems by changing habitat structure, water quality, and the connectivity of aquatic environments. These changes may affect biodiversity and reduce opportunities for gene flow between populations. This project investigates the potential effects of urbanization on biodiversity and genetic connectivity within freshwater systems, using dragonflies as the primary organism. Dragonflies are particularly useful for this research because they are closely associated with freshwater habitats and can provide insight into the ecological conditions of the environments in which they are found. Dragonfly nymphs are collected from multiple streams throughout Mecklenburg County, North Carolina. Following collection, specimens are identified to determine their family and genus using a standardized dichotomous key. Molecular analysis is then conducted to examine genetic characteristics among collected individuals. DNA is extracted and amplified using polymerase chain reaction (PCR), followed by gel electrophoresis to evaluate the success of amplification. A primary objective of this analysis is to evaluate success of amplification of the 16S gene from two different dragonfly species to determine if there is a species bias for amplification. This data will provide a basis for comparing genetic variation among populations and sampling locations. By examining genetic connectivity across urban freshwater systems, this research may provide insight into how urban development influences the movement and genetic diversity of aquatic organisms. The findings of this project will hopefully contribute to a broader understanding of freshwater ecosystem health. This understanding should help inform future conservation and management strategies aimed at maintaining biodiversity and connectivity within increasingly urbanized environments.

ADHD: Differences in Academic Skills, Brain Activity, and Cognition

Eva Richardson

Mentored by: Daniel Krenzer

High Point University

Our study investigates cognitive and academic differences between students formally diagnosed with ADHD and those who are self-diagnosed. ADHD is a neurodevelopmental disorder characterized by a pattern of inattention and/or hyperactivity-impulsivity to an extent that has been observed to impact social, academic, or work functioning. EEGs have been used to identify changes in cortical activity in children with ADHD (Anders et al. 2023). Students formally diagnosed with ADHD, self-diagnosed with ADHD, and without ADHD were compared using an EEG, reading tasks, and the Montreal Cognitive Assessment – Xpresso (MoCA), etc. By comparing students formally diagnosed with ADHD, self-diagnosed with ADHD, and without ADHD, it was observed that those formally diagnosed experienced higher levels of stress, were medicated, and performed moderately better on the two reading tasks. The EEG data indicated differences in brain activity between the ADHD and non-ADHD groups, which is consistent with previous research. The higher scores on the reading tasks indicate that medication has a mitigating effect on symptoms that typically worsen academic performance. Most ADHD research has previously been conducted on children, so it is important to broaden our understanding of how it affects young adults. By identifying ways that ADHD affects students' cognition and academics, this study provides insights for educators, students, and medical professionals. References Anders, M., Dreismickenbecker, E., Fleckenstein, J., Walter, C., Enax-Krumova, E. K., Fischer, M. J. M., Kreuzer, M., & Zinn, S. (2023). EEG-based sensory testing reveals altered nociceptive processing in elite endurance athletes. Experimental brain research, 241(2), 341–354. https://doi.org/10.1007/s00221-022-06522-4

American ginseng as a modulator of tau clearance via the autophagy-lysosomal pathway

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Mentored by: Jonathan Schisler

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Alzheimer's Disease (AD) is a progressive, degenerative brain condition characterized by marked cognitive decline. AD pathological hallmarks are extracellular amyloid-beta (Aβ) plaques and intracellular neurofibrillary tangles, the latter primarily formed by the microtubule-associated protein tau (MAPT). Both accumulate over years as protein homeostasis becomes impaired with aging. Enhancing protein clearance pathways, particularly the autophagy-lysosomal pathway (ALP), is therefore a promising strategy for removing toxic protein species from the brain. Panax quinquefolius (American ginseng; PanQ) was recently shown to enhance protein clearance by activating the ALP in non-disease models. Here, we tested whether PanQ promotes the clearance of aggregation-prone human tau through ALP activation. We treated HEK293 cells with PanQ to assess ALP activation by measuring expression of the lysosomal protease cathepsin B (CatB) and lysosomal activity with LysoView 550 in live cells. Next, using HEK293 cells expressing human tau carrying the P301L and S320F mutations (PL-SF), which together drive rapid and reproducible tau aggregation, we evaluated levels of tau PL-SF and the pre-tangle phospho-tau marker AT8 by immunoblotting and immunofluorescence. PanQ increased CatB expression and enhanced lysosomal activity. Preliminary results suggest that PanQ reduces tau PL-SF accumulation through the ALP. These findings identify PanQ as a potential modulator of tau clearance. Further studies are needed to validate these effects in neuronal and in vivo models and to assess PanQ's translational potential for AD and related tauopathies.

Are there any minerals of economic or scientific significance in sedimentary rock from the Sandhills region of North Carolina?

Martha Robbins

Mentored by: Gretchen Miller

Wake Technical Community College

Are there any minerals of economic or scientific significance in sedimentary rock from the Sandhills region of North Carolina?The Sandhills region of North Carolina contains sedimentary deposits associated with the Cretaceous Middendorf Formation that may preserve heavy-mineral assemblages containing rare earth elements (REEs) and critical minerals. Exact coordinates for the KC25 sample of mid-Cretaceous sandstones of Cape Fear Formation in the Sandhills region are 35°08’59.9”N,078°51’21.9W.This research investigated sediment samples collected near Pinehurst, North Carolina, to determine their heavy-mineral composition and evaluate the potential for REE and critical minerals. Samples were processed using heavy-liquid separation to remove abundant low-density minerals, primarily quartz and feldspar, and concentrate the heavy-mineral fraction. Sample grains of 355-250 μm fraction and 250-125 μm fraction were mounted and analyzed at NCSU's lab using scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS). Minerals were identified based on grain characteristics and element composition. SEM-EDS analysis revealed a diverse assemblage of heavy minerals and identified trace occurrences of REEs like Cesium and Neodymium that are found in the mineral monazite. Other critical minerals like Tungsten and Titanium, found in the mineral ilmenite, were identified within the sediment samples. These results demonstrate presence of potentially significant REE and critical minerals within sediments of the NC Sandhills. Additional sampling and quantitative geochemical analyses are needed to determine their abundance, distribution, and economic significance, this study gives initial characterization of mineral occurrences and establishes foundation for further investigation of critical mineral resources within the Middendorf Formation and surrounding Sandhills region.

Targeting Immune Pathways to Enhance the Oncolytic Potential of Reovirus Against Fibrosarcoma

Alexander Roberts

Mentored by: Efrain Rivera-Serrano

Elon University

Oncolytic virotherapy is an emerging cancer treatment strategy that uses viruses to selectively infect and kill tumor cells while also stimulating antitumor immune responses. Reovirus is a naturally occurring virus with oncolytic potential in multiple cancers. Previous work from our laboratory identified reovirus variants with enhanced ability to infect and kill HT-1080 human fibrosarcoma cells, but the tumor-cell antiviral responses that distinguish highly oncolytic from poorly oncolytic reoviruses remain unclear. Because type I interferon signaling and interferon-stimulated genes can restrict viral replication, we are investigating how antiviral immune pathways shape reovirus oncolytic potential in fibrosarcoma cells. To identify host responses associated with reovirus sensitivity or resistance, we compared transcriptomic responses induced by oncolytic and non-oncolytic reovirus variants. RNA-sequencing analysis revealed that non-oncolytic reoviruses induced a stronger interferon-associated transcriptional response than more oncolytic variants, suggesting that heightened antiviral signaling may limit productive infection and tumor cell killing. We are examining protein kinase R (PKR), an interferon-inducible antiviral protein that can inhibit viral protein synthesis. We found that reovirus infection increased PKR protein levels in HT-1080 cells without altering its intracellular localization. Using siRNA-mediated PKR knockdowns, we reduced PKR expression and improved the virus's oncolytic ability by measuring cell viability. Ongoing experiments are using CRISPR PKR knockouts to determine whether reducing PKR expression enhances reovirus replication, cytotoxicity, or overall oncolytic activity. Together, these studies will help define how interferon-stimulated antiviral defenses influence reovirus-mediated killing of fibrosarcoma cells and may identify host pathways that can be targeted to improve oncolytic virotherapy.

Designing and Synthesizing a Small Molecule Inhibitor of Schistosoma Mansoni Phenoloxidase to Inhibit Sclerotization

Alaina Roberts

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

Schistosoma mansoni, commonly known as the blood fluke, causes intestinal schistosomiasis, a chronic parasitic disease affecting an estimated 54 million people in more than 70 countries. Parasitic infection spreads through contact with freshwater contaminated with infectious larval forms. Following host penetration, these larvae mature into adult worms that lay eggs to reproduce; the entrapment of parasite eggs within host tissues causes immune reactions and progressive organ damage. Current treatment is limited to praziquantel, raising concerns regarding drug efficacy and emerging resistance. Phenoloxidase is a core component of invertebrate defense and a driver of eggshell sclerotization. However, it is not a common target due to structural homology with human tyrosinase, the enzyme responsible for melanization. This project aims to develop a selective S. mansoni phenoloxidase inhibitor to disrupt sclerotization without disrupting human melanization. This study focuses on computational design, synthesis, and testing in Drosophila melanogaster with activated prophenoloxidase. Through Schrödinger Maestro, the active site of S. mansoni was constructed through homology modeling, identifying two indole-based inhibitors. One is a commercially available form of indoleacetic acid , while the other is a novel indole core substituted with a carboxymethyl and a chlorine atom. Chemical synthesis of this candidate is underway using a process for producing 3-indole propionic acids. The existing indoleacetic acid was tested against an enzyme inhibition model, showing positive results at lower molarities against phenoloxidase and minimal effect on human tyrosinase. With successful synthesis and positive in vivo testing, this project will establish a targeted framework for next-generation antischistosomal drug discovery.

Understanding the Obesity Epidemic Utilizing the Biopsychosocial Model

Harlee Roberts

Mentored by: Tracy Bonoffski

University of North Carolina at Charlotte

The medical field primarily relies on the biomedical model to treat and diagnose patients, although this may not be the best model for analyzing complex medical conditions, such as obesity. In this literature review, I examine how the biopsychosocial model can be utilized to analyze the factors that contribute to the development of obesity. Synthesizing peer-reviewed articles across public health, psychology, medicine, and social science disciplines from 2001 to 2025, this review reveals the biological, psychological, and social factors that contribute to the development of obesity. These findings suggest that psychological and social factors such as body image, stress, trauma, culture, location, socioeconomic status, and government should be considered alongside the biological factors usually associated with obesity to best treat and prevent obesity. The contribution of this literature review is to show that the biopsychosocial framework can help physicians and patients to find prevention and treatment plans that are not just quick solutions but instead allow for long-term prevention and results.

The Benefits and Challenges of Providing Music Therapy in Community-Based Settings

Harlee Roberts

Mentored by: Vaughn Schmutz

University of North Carolina at Charlotte

Music therapy is the clinical use of music to help a patient achieve physical, emotional, cognitive, and social goals. Piedmont Music Therapy provides its services to the Charlotte Metro community in individual and group settings to help the community achieve goals and improve their life with the help of music therapy. Working with and providing services to the community comes with challenges for the music therapists at Piedmont Music Therapy. The purpose of this project is to highlight the difficulties that music therapists face when providing services to the community and the benefits of providing music therapy to the community. Through the use of observations at Piedmont Music Therapy, prior literature, analysis of intake forms, and other data sources, the project will show the difficulties that Piedmont Music Therapy faces when providing its services to the community. The project will highlight challenges such as scheduling with community partners, lack of awareness surrounding the field of music therapy, funding, and discrepancies between patients' preferences and what is easiest for music therapists to provide. It will also highlight the benefits of providing music therapy, such as helping people achieve their goals and improve their quality of life in many different groups within the community.

The Limitations of Extending Empathy

Ashley Robinson

Mentored by: Elizabeth Stearns

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This presentation will highlight the moral lines and boundaries students draw when extending empathy. This research is significant because it highlights the moral boundaries that Generation Z holds that disrupt civic empathy, productive discourse, and polarization. The study this presentation comes out of is "Civic Empathy among College Students," whose main goal is to answer the "...very important question… how groups of people with differing political opinions might be able to get along with one another. It is a question of fundamental importance to the future of democratic society". This study defines empathy as "the ability to understand and share the feelings of another person," and through interviews, 11-30 students who have recently taken general education courses are asked a series of questions in one-on-one interviews. For the sake of this presentation, the focus will be on the empathy section of the interview, honing in on the question: "How do you feel about understanding or working with people who are politically different from you?" and subsequent follow-up questions. A key takeaway of this presentation is that there are named explanations for empathy being limited, which creates a foundation for civic discourse, debate, and polarization, and for organizations to understand the basis for hesitancy in participation in discourse and political othering.

Genomic and Phenotypic Characterization of Antimicrobial Resistance in Enterococcus from the Gut of Galleria mellonella

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Mentored by: Carlos Goller, Claire Gordy

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Galleria mellonella, the greater wax moth, is a common pest of honeybee hives; its larvae live inside these hives and may exchange microbes with bees, wax, and the surrounding environment. Enterococcus species dominate the gut microbiome of G. mellonella, but little is known about whether they serve as reservoirs of antimicrobial resistance (AMR). These bacteria could introduce resistance traits into apiaries, where antibiotics are used, making them less effective. Bacterial isolates were cultured from larvae feeding tubes from two commercial worms, grown on tryptic soy agar, and identified by 16S rRNA Sanger sequencing. Whole-genome sequencing was performed using the Oxford Nanopore Technologies MinION. Genomes were assembled, annotated, and screened for resistance genes using the BV-BRC web-based bioinformatics platform. Phenotypic data were profiled with Biolog GEN III microarray plates. Eleven Enterococcus isolates were collected, including E. faecalis, E. casseliflavus, and the recently described species E. innesii. A fosfomycin resistance gene, fosX, was found in all E. casslifavus isolates, the only E. innesii isolate, and one E. faecalis isolate. Biolog profiling also showed strain-level differences in tolerance to vancomycin, minocycline, and rifamycin SV. Ongoing work will apply the same methods to wild wax worms found in North Carolina apiaries. Together, this work establishes a baseline for evaluating wax worms as potential reservoirs of AMR in beehive ecosystems and how two very different environments might shape resistance differently.

Analysis of Fluid Mechanics using Piezoelectrically Generated Acoustic Waves

Carmela Rogers-Gonzalez

Mentored by: Tandy Grubbs

North Carolina School of Science and Mathematics

Industrial plants rely on organized systems of closed pipes in order to deliver chemicals and liquids to essential mechanical parts. However, when there is an error in this system, it can be suboptimal to detach and reattach pipes in order to analyze the properties of the liquids that are inside of them. Surface acoustic wave sensors (SAW sensors) can be used to create and measure propagating surface waves. They are mainly used to determine specific properties of a chemical substance or liquid through the measurement of its change in wave properties. To replicate this effect without purchasing specific SAW components, this study will be focusing on the abilities of piezoelectric buzzers to detect the specific viscosity change in a liquid running through a model pipe. One piezo is used to propagate surface waves which vibrate the pipe while the other senses the waves that are being propagated, the difference in wave properties; such as amplitude, frequency, and DC offset, between the sensor and propagator can be used to determine the flow rate of a liquid.

Comparing Effects of Mutations in p53, the Guardian of the Genome

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Mentored by: Ellen Wisner

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The “Guardian of the Genome” is a well-known nickname for p53. p53 is a tumor-suppressor protein that helps arrest the cell cycle, preventing damaged cells from continuing to reproduce and form tumors. Dysfunctional p53 is common in human cancers, making it part of an important tumor-suppressor pathway to study. The protein plays an important role in regulating gene expression and helps to regulate uncontrolled cell growth. Mutations in p53 can affect its ability to transactivate, or turn on, target genes such as CDKN1A (which stop cell division) or BAX (which triggers damaged cells to undergo programmed cell death, apoptosis). This experiment will compare the transactivation ability of four p53 mutants, T155N, G154V, Y220C, and L344P, in a yeast model system. We chose these mutants as they appear frequently in human tumors and are well documented. We will use an ADE2 spot assay to qualitatively investigate how these mutations impact p53’s ability to transactivate genes, including p21, which pauses the cell cycle by blocking kinases, and Bax, which promotes apoptosis. A β-galactosidase kinetics assay will allow quantitative measurement of transactivation for the p53 mutants. By comparing these results with wild-type and delta p53, the effects of each mutation on p53 transactivation can be determined. We predict that the mutations will have the greatest impact on transactivation in this order: Y220C, followed by L344P, T155N, and G154V, due to a combination of the location of the mutation, the polarity, and size of the new amino acid.

Impacts of Treatments on Cytoskeletal Structures of Equine Activated Fibroblasts

Addison Roper

Mentored by: Rosemary Bayless

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Fibrosis is a feature of many chronic disease processes in human and veterinary patients, can affect many different organs and tissue types, and often results in irreversible scarring and tissue dysfunction. Fibrosis occurs when inappropriate fibroblast activation, associated with cytoskeletal remodeling and increases in α-smooth muscle actin (αSMA), leads to excess deposition of extracellular matrix. Thus, the identification of therapeutic targets that interrupt cytoskeletal remodeling pathways in fibroblasts is an important step toward novel medical interventions for fibrotic conditions. We hypothesized that combinatorial treatment with known cytoskeletal inhibitors, Withaferin A (WFA) and CK666, would downregulate the expression of key cytoskeletal markers, such as αSMA, F-actin, and vimentin, in equine primary fibroblasts pre-activated with TGF-**β**1. Changes in cytoskeletal structure and gene expression were investigated in activated fibroblasts using immunofluorescence and qPCR. Additionally, using live confocal microscopy, we evaluated the dynamics of structural changes within focal adhesions via cells transfected with fluorescently-labeled paxillin and vinculin vectors. We found that co-treatment with WFA and CK666 reversed markers of fibrosis in activated equine fibroblasts, suggesting that this combination may have therapeutic potential in the reduction of tissue scarring.

Development and Characterization of a Prototype Regolith-Driven Rotational Triboelectric Nanogenerator System for Lunar Surface Applications

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Mentored by: Eve Klopf

High Point University

This project explores the use of a rotating triboelectric nanogenerator (R-TENG) as a possible source of power to support activities at lunar lander locations during the lunar night or in permanently dark regions of the lunar surface. Lunar regolith is typically displaced by lunar landers ascending or descending from the lunar surface. This project presents a prototype system which could potentially use displaced regolith as a source of rotational force for power generation. Power which is generated using a system of this type during the ascent or descent of lunar landers could then be used for purposes such as powering sensors in the area surrounding the lunar lander. The prototype system includes a wheel oriented perpendicular to the expected travel direction of the displaced dust which could be used to convert the dust's momentum into rotation of the wheel and, consequently, of the R-TENG's rotor. As the rotor spins, the varying motion between the sections of the R-TENG's rotor and stator results in a cyclic variation of the potential difference across the R-TENG and supplies an AC current to an attached load. The prototype R-TENG has been enclosed in a housing which is intended to protect the R-TENG from the abrasive properties of the dust. Impact surfaces such as the fan blades have been designed to be easily replaceable. Although further development is needed for this system to be used on the lunar surface, this prototype system acts as a proof of concept for a regolith-driven R-TENG system.

Optimizing Multi-Detector Coincidence Thresholds for Pre-Supernova Neutrino Detection

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Mentored by: Joshua Queen

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Core-collapse supernovae, the explosive deaths of massive stars, emit approximately 99% of their energy as neutrinos – weakly interacting particles that escape the collapsing star hours before the explosion becomes visible. Detecting these neutrinos provides insight into the supernova's (SN) internal collapse, enabling scientists to study the explosion mechanism and issue earlier alerts than light alone. However, random background events, such as atmospheric neutrinos and natural radioactivity, can mimic a true SN signal, making reliable detection challenging. Although the SuperNova Early Warning System (SNEWS) reduces false alarms by requiring coincident triggers across multiple detectors, optimal event-count thresholds remain unclear, especially for small detectors with varying background rates. This project develops a statistical framework to determine the coincidence thresholds needed to distinguish real SN signals from background while minimizing false alarms. Simulated Poisson-distributed data, which model the random occurrence of background events, were generated for multiple detectors with varying background rates. Poisson statistical functions were used to compute event-count thresholds corresponding to specified false-alarm probabilities, and detector coincidences were evaluated as detector parameters varied. Detector-specific false-alarm probabilities were optimized to maximize sensitivity to a simulated supernova signal while maintaining a background coincidence rate of one false alarm per 500,000 trials. These findings agree with theoretical expectations for independent detector coincidences and provide a statistical basis for optimizing multi-detector thresholds, extending the reach of smaller detectors so they can contribute reliably to SN searches. Future work will validate the framework using data from COHERENT and other neutrino detectors as they become available.

Optimizing Simulation Settings in Quantum Computing

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Mentored by: Berndt Mueller

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Quantum computing promises an orders-of-magnitude increase in computational speed, but its practical usage is limited due to high error rate. We examined how errors could be minimized for simulating the time evolution of spin of qubits, the unit of data in quantum computing. The aggregate spin of the ensemble gives its magnetization. In this setting there is a theoretical formula based on the system's Hamiltonian which gives the exact solution, hence errors from other models can be evaluated. Quantum computing based simulation code for the system was developed using IBM's Qiskit package in Python. The interaction between particles was modelled using a Transverse Field Ising Model across multiple ensemble sizes and field ratios. The time evolution was approximated using Trotter's approximation of various orders. Mean absolute errors were calculated over n = 8000 shots. This study finds that magnetization dynamics are strongly sensitive to initial state symmetry and the quantum critical point of the system's Hamiltonian. Increasing physical gate time or depolarizing noise degrades the advantage of higher-order Trotter formulas, and 2nd-order Trotter generally performs the best. The optimal number of time steps used for approximation achieves a minimum which is dependent on system configuration. The results provide a framework for optimizing digital quantum simulation parameters, balancing algorithmic accuracy against noise constraints on near-future quantum hardware.

Effect of Particle Size on the Photocatalytic Degradation of Perfluorooctanoic Acid Using Brookite Phase Titanium Dioxide

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Mentored by: Oksana Love

University of North Carolina at Asheville

Per- and polyfluoroalkyl substances (PFAS), including perfluorooctanoic acid (PFOA), are environmentally persistent contaminants that pose long-term risks due to their exceptionally strong carbon-fluorine bonds. Developing effective degradation strategies is critical for overcoming this chemical stability problem and mitigating the long-term environmental impacts of PFAS contamination. The objective of the study is to investigate the differences in the particle size and morphology of brookite-phase titanium dioxide (TiO2) and how they influence the phopocatalytic degradation of PFOA in water. Pre-synthesized brookite TiO2 particles with distinct sizes and morphologies, including nanoparticles and larger flower-like structures, will be compared to determine how these physical characteristics affect the photocatalytic performance. Brookite TiO2 was selected due to its photocatalytic properties and its potential to promote interfacial electron transfer under ultraviolet irradiation. Photocatalytic reactions will be conducted under controlled ultraviolet exposure to generate reactive species capable of initiating oxidative degradation pathways. Degradation efficiency will be evaluated using liquid chromatography- mass spectrometry (LC-MS) to quantify PFOA concentrations at environmentally relevant parts-per-billion levels. A calibration curve will be constructed to ensure analytical sensitivity, linearity, and reproducibility, enabling accurate monitoring of concentration changes over time. LC-MS data analysis will be performed to assess degradation kinetics and evaluate the effectiveness of brookite TiO2 for photocatalytic degradation of PFOA. This work aims to establish an analytical framework for assessing PFAS degradation and to contribute to the development of chemistry-based remediation strategies for persistent fluorinated contaminants in water systems.

Synthesizing and Evaluating Racemic α-Lipoic Acid Loaded Sodium Alginate-Carboxymethylcellulose Hydrogel Beads for Controlled pH-Responsive Delivery

Aarohi Salaria

Mentored by: Tandy Grubbs

North Carolina School of Science and Mathematics

Oral administration of racemic -lipoic acid (RS-ALA), a potent antioxidant, is severely limited by rapid degradation, low gastric solubility, and a brief 30-minute plasma half-life. While standard single-network hydrogels are growing in prominence to encase such drugs, they often fail to prevent premature drug loss and maintain controlled release in gastrointestinal conditions. To overcome these limitations, hybrid sodium alginate-carboxymethylcellulose (NaAlg:NaCMC) composite hydrogel beads spanning five mass ratios (1:0 to 1:1, 4.0% w/v) were synthesized via 0.2 M CaCl2 ionotropic cross-linking under light-restricted conditions. Encapsulation efficiency (EE%), drug loading capacity (LC%), swelling dynamics, and release kinetics were evaluated in simulated gastric fluid (SGF) pH 1.2 before later being transferred to simulated intestinal fluid (SIF) pH 7.4 at 37ºC using a 10-stage temporal sampling profile over one week. Increasing NaCMC content altered composite viscosity and cross-linking density, yielding optimal bead morphology at the 3:1 ratio with an EE% of 93% and LC% of 21%. Furthermore, in SGF, suppressed matrix swelling prevented premature gastric leakage (12%), and upon transfer to SIF, carboxyl deprotonation driven by elevated pH triggered network expansion and sustained drug release (92% over 24 - 168 h). This indicates the process of anomalous non-Fickian diffusion (n = .67) within the composite matrix. Hence, SA-CMC composite hydrogels shield RS-ALA from gastric degradation to achieve targeted, pH-responsive intestinal release, paving the way for future studies assessing the in vivo bioavailability and efficacy of RS-ALA.

US Domestic Radicalization and Extremism: Elements, Stages, Deradicalization and Recommendations for Law Enforcement and Professionals

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Gardner-Webb University

Radicalization and violent extremism is one of the most significant threats to public safety and national security in the United States. This research proposes a four-stage process of radicalization consisting of Antecedent, Awakening, Adoption and Action. While the radicalization process is not simple, this four-stage model integrates psychological theory, historical examples and current research to explain the radicalization process in a memorable and simple way. The model includes the beginning before an individual becomes radicalized as well as the shaping of the individual's extremist views based on radicalization elements proposed in this research. This research also examines the role of the internet and use of artificial intelligence in accelerating the radicalization process as well as legal and ethical challenges law enforcement is faced with. Using the proposed model, this research explores how law enforcement can use the model to better understand the process of radicalization, identify and ultimately assist in the process of deradicalization. The Oklahoma City Bombing and Timothy McVeigh are presented as a Case Study to demonstrate the use of the proposed model, efforts of deradicalization as well as detection and intervention methods. The proposed model creates a structured approach for recognizing, interrupting and reversing the radicalization process before extremist violence occurs. This paper will also include changes and recommendations for law enforcement to improve integration of information and communication. Keywords: Radicalization, Domestic Extremism, Deradicalization, Law Enforcement, Radicalization Stages

The Evil On Stage: The Sexualization Of Women In Performing Arts

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This project addresses the oversexualization of competition dancers spanning from the start of a dancer's career to those who have become stars and media focused, and how they are able to explore their self and sexual expressions. This connection between expression and dance then exposes the media to the dance worlds' ways of allowing exploration, which leads to the endangerment of performers and desensitization of the public to sexual violence. My research consists of accounts from dancers who grew up in competition dance, memoirs and works of pop stars, alongside papers which cover the importance of arts and sports, sexualization in media, and young dancers in competitions. From these sources, I make the claim that the ways dance impacts dancers' relationship between sexual expression and self sexualization can be adapted to support a healthier relationship between dance and the media. The amalgamation of these subjects together poses questions such as: where is the line of what is appropriate for young dancers to perform publicly? When did dance come to the point of sexualizing dancers? How does this impact young dancers' development as they age? Is there good that could come out of self sexualization? Does the sexualization of dancers lead to more sexual violence? For the generations of dancers to come, it is important to understand this topic and if the dance world and the media can be changed to encourage healthy growth.

Picturing the Metaphor: Comparing Prompting Strategies for AI-Generated Companion Images to Support Cross-Disciplinary Reading

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Cross-disciplinary readings can be difficult to comprehend when the reader is used to their own discipline's context; ideas from one field might not mean the same in another. Abstract metaphors can bridge this gap by connecting a reader’s existing knowledge to unfamiliar concepts, and Large Language Models (LLMs) make it possible to generate such metaphors on demand. Pairing a metaphor with a companion image could deepen that understanding, but it is unclear how to generate complementary images. This prompted the research question: what image prompt strategies create the best companion image for a text metaphor? A prompt template was developed to extract four elements from the metaphor (setting, characters, theme, and conflict), with visual style as an adjustable variable. Four prompt strategies (raw metaphor, a free-form LLM rewrite, a template-guided LLM rewrite, and the template alone) were tested across three image models. Images were evaluated in a two round pilot study with Human-Computer Interaction (HCI) students (n=3) using a rubric grounded in metaphor-design literature. Preliminary ratings suggest that an LLM rewrite step may not be necessary: the raw metaphor and template-alone conditions performed comparably, and preferred images were rated high in mapping fidelity, meaning their elements reflected the metaphor's key points. Follow-up discussion also suggested the most effective visual style may depend on the subject matter. These findings will inform prompt design for complementary images for a metaphor, with future work testing whether metaphor-image pairs improve readers' understanding, making interdisciplinary research more accessible.

Is MyPlate Really for Everyone? A Critical Examination of MyPlate Through a Cultural Lens

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Mentored by: René Ibarra

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The Hispanic population in the United States is disproportionately affected by numerous health issues, including heart disease, obesity, and diabetes. One major factor is the influence of culture on food, which not only provides nourishment but also serves as a bond among families and communities. This paper delves into the MyPlate program and its inability to appropriately provide culturally responsive nutritional messaging to Latin American communities. While MyPlate is designed to provide guidance towards supporting healthy eating behaviors, it is important to consider how nutritional campaigns may not be culturally appropriate. Thematic analysis is used to identify recurring cultural considerations within existing literature and compare these considerations with the assumptions and recommendations reflected in the MyPlate program. Examining these intersections highlights how family practices and cultural understandings of food can affect the way nutritional messages are received, suggesting that effective nutrition programs must take into account the cultural aspects of the communities they aim to serve.

Triphala-Derived PLGA Nanoparticles as a Non-Surgical Intervention Against Crystallin Aggregation in Age-Related Cataracts

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Mentored by: Santhakumar Rajendran

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Age-related cataracts are the leading cause of preventable blindness globally, yet surgery remains the only available treatment. No pharmacological option exists to prevent or slow cataract progression, representing a critical unmet clinical need. Cataracts form when oxidative stress triggers misfolding and aggregation of crystallin proteins in the ocular lens. Triphala, an Ayurvedic formulation with centuries of traditional use in eye care, contains gallic acid and ellagic acid, compounds with documented antioxidant and anti-protein-aggregation properties. However, these compounds cannot penetrate ocular tissue at therapeutic concentrations in free form, necessitating an improved delivery system. This study investigates whether biodegradable PLGA nanoparticles loaded with Triphala-derived gallic acid and ellagic acid can prevent oxidative stress-induced crystallin aggregation in human lens epithelial cells, offering a potential non-surgical pharmacological intervention for cataracts. Nanoparticles will be synthesized by nanoprecipitation and characterized for size, morphology, and encapsulation efficiency via UV spectroscopy, transmission electron microscopy, and HPLC. Cellular efficacy will be assessed by exposing HLE-B3 lens epithelial cells to hydrogen peroxide to model oxidative stress, comparing nanoparticle-delivered compounds to free compound treatment through cytotoxicity and protein aggregation assays. A computational drug release model will identify optimal nanoparticle formulation parameters for sustained ocular delivery. We hypothesize that encapsulation will enhance compound stability and cellular protection compared to free compound administration, establishing a foundation for the first Ayurvedic-derived nanoparticle intervention against cataract progression.

Effect of Sweetpotato-to-Water Ratio on the Viscosity and Estimated Sweetness of a Sweetpotato-Based Milk Alternative

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Mentored by: Brett Taubman

Cox Mill High School

Plant-based milk alternatives (PBMA) are rapidly growing in popularity as consumers move away from dairy for environmental, ethical, and health reasons, including high rates of lactose intolerance. However, many PBMAs are resource-intensive to produce and are lower in nutrition than dairy milk, particularly in digestible protein. Sweetpotato milk offers a solution because it is high in protein from an ingredient added during processing, contains none of the major allergens, and comes from an economical, locally grown crop. This study measured how sweetpotato-to-water ratio affects the mouthfeel and flavor of sweetpotato milk across five ratios, with the goal of finding the balance that produces the best product. Mouthfeel was evaluated by measuring kinematic viscosity with a manual viscometer and apparent viscosity with a rheometer, and linear regressions for both data sets were calculated using least-squares approximation. Flavor was evaluated through glucose concentration, measured with a standard glucose-fructose enzymatic assay, and relative sweetening power was calculated using a sweetening index. A hedonic taste test was then used to compare subjective preferences between samples. Results showed that increasing the sweetpotato-to-water ratio increased both sweetness and viscosity, and most participants preferred the intermediate 1:3 ratio over the 1:1, 1:2, 1:4, and 1:5 ratios.

The “First 1000 Days”: Early Nutrition’s Role on Childhood Food Allergy Onset

Kae Saotome

Mentored by: Yuka Saotome

North Carolina School of Science and Mathematics

Food allergy affects approximately 5.6 million children in the United States, and over the past 30 years, this number has increased, particularly in developed countries. The shift in human diet and environmental exposures in recent years are thus suggested to be associated with childhood food allergy onset, especially during the period known as the “First 1000 Days.” This period of a child's life, spanning from conception to a child's second birthday, is a critical window where nutrition plays a vital role in organ formation, gene expression, and the development of the gut’s microbiome. This review investigates the impact of specific nutritional intake during the First 1000 Days on the likelihood of food allergy onset in children. Peer-reviewed studies published between 2017 and 2026 were analyzed to identify how nutritional factors during the First 1000 Days window impact children’s development of food allergies. Findings revealed a correlation between nutrition-related gut microbiome shifts and the likelihood of a child developing a food allergy, as well as gaps in current research. The insufficient number of clinical studies on human subjects and the lack of standardization of such research methods direct future studies toward establishing a more comprehensive causality between the two variables. Food allergies impact fetuses, infants, and young children, while also impacting caregivers and healthcare providers tasked with managing these conditions. Learning about the risk factors may assist healthcare professionals and households in actively preventing these conditions through clinical guidance and early lifestyle decisions.

Redefining Autonomy: Subverting Parkinson's Disease Stigma Through Narrative Medicine

Udayan Satapathy

Mentored by: David Cantrell

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In Western societies, cultural values prioritize youth, physical control, and self-sufficiency, framing visible motor disruptions as signs of cognitive decline and aging. This research project investigates how contemporary media representations reinforce the cultural stigma surrounding Parkinson's disease and examines how patient-generated illness narratives—analyzed through narrative medicine—subvert these portrayals to restore communal autonomy and reduce patient isolation. Drawing on public health communication studies, sitcom analysis, and digital video discourse, this study evaluates how broadcast and online media flatten chronic suffering into comedic tropes or simplistic technological fixes. To counter these reductionist portrayals, this project applies the theoretical frameworks of Rita Charon and Arthur Frank to conduct a textual and visual analysis of graphic memoirs, focusing on Peter Dunlap-Shohl's My Degeneration. Findings indicate that while mass media reduces Parkinson's disease to hyper-visible tremors or mechanical failures, patient-generated accounts reframe autonomy from individual physical control to a practice of interdependence and shared support. By centering the lived experience of illness rather than external bodily appearance, patient narratives challenge public scripts of ageism and cognitive decline. This research contributes to medical humanities and media critique by demonstrating how narrative medicine can dismantle societal stigma, reshape care dynamics, and foster community-based models of agency for individuals living with neurodegenerative conditions.

Design and Synthesis of Novel Pyridone-Derived Unnatural Amino Acids for Gene Delivery

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Mentored by: Bharathi Pandi

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Delivering genetic material into cells remains challenging because nucleic acids are vulnerable to degradation and have limited ability to cross cellular membranes. This project explores whether new unnatural amino acids can provide building blocks for peptide carriers with properties suited to gene delivery. The study titled 'Novel Cell-Penetrating Peptide and Uses Thereof' provides an example of how researchers can modify amino-acids sequences to create a delivery system. It uses the protein PEP-1 to support the idea of how peptides can be engineered and modified to create different gene-delivery properties. Our synthetic approach uses methoxy pyridinium salts and selected nucleophiles to generate pyridone-derived intermediates that can be developed into amino acids bearing additional amine functionality. Incorporating these building blocks into short peptides is expected to increase their capacity to associate with negatively charged nucleic acids while allowing the peptide sequence and charge distribution to be tuned. The project will examine the synthesis and structural characterization of candidate amino acids, followed by peptide design and initial evaluation of their interactions with model nucleic acid cargo. Planned studies will assess particle formation, cargo association and protection, and, where feasible, cellular uptake and functional delivery using a reporter system. The central question is whether the position and number of amine groups in these new building blocks improve delivery-related properties without unacceptable effects on cells. This work aims to establish a chemical foundation for modular peptide carriers and identify candidates for further study as nonviral gene-delivery materials.

On the Impact of Initial Entanglement in a Two-Spin Open Quantum System

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Mentored by: Donald Jacobs

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The theory of open quantum systems commonly uses the density matrix formalism and associated master equations to describe nonunitary dynamics. Among these, the Lindblad master equation is one of the most widely used and generates completely positive reduced dynamics under its standard assumptions. For an initially uncorrelated system and environment, complete positivity of the reduced dynamical map is guaranteed and can be expressed through a Kraus operator representation. Whether complete positivity is satisfied or not becomes more subtle when correlations between the system and environment are present initially, since the reduced dynamics need not define a completely positive map on the full system state space. This project investigates the complete positivity of Lindblad reduced dynamics in the presence of such initial correlations. We develop a computational model consisting of two spin-½ particles with tunable initial entanglement and optional spin-spin interactions. Standard Schrödinger evolution of the composite system provides a reference against which reduced Lindblad dynamics are compared. Complete positivity is examined computationally as the degree of initial system-environment correlation is varied. The results will clarify the conditions under which Lindblad models provide a completely positive description of open quantum systems with initially correlated system and environment states.

The Shrimp Effect: How color-concept associations update when objects change colors

Skylar Scobbo

Mentored by: Melissa Schoenlein

High Point University

We live in a colorful world that changes around us every day: leaves change color based on the season, chameleons use camouflage, or even social media companies modify their logos. Flamingos also experience a color shift over the course of their lives due to their diets of mostly shrimp. In our research, we are exploring whether cause and effect changes influence the colors people associate with an object. Specifically, we are testing whether people form stronger associations to the object's original color or to the color the object changes to. In our experiment, participants watch videos featuring Speatures (bird-like animals) and Nerks (bug-like animals) interacting. In some trials, participants see a Speature eat a Nerk and change color. In other trials, Speatures eat a different type of Nerk but do not change color. And, sometimes Nerks do not get eaten at all, and therefore Speatures do not change color. Afterward, participants answer questions about how much they associate different colors to the Speatures. We predict that participants will form stronger associations to the colors that the Speatures changed to compared to their original colors. Through this research we can better understand the process of association formation and gain insight into how humans respond to changes in their environment.

Hitchhikers Informants: An Investigation into Potential Transference of Microbial Population During the Handling of Unfired Ammunition

Amaya Scott

Mentored by: Khalid Lodhi

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This study investigates the transfer of microbial populations from human hands to handled objects and evaluates whether microbial profiles can associate an object with its handler. Seven participants (n=7) were sampled during summer (2025) and resampled during winter (2026) to assess seasonal variations of microbial population. Participants' hands were double swabbed using wet/dry collection method, and hand samples were quantified for human DNA using qPCR technique. Each participant handled an unfired 9 mm brass or 7.62 caliber steel cartridge casing with each hand for 30 seconds. Cartridge casings were subsequently double swabbed to collect transferred microbial DNA. Microbial DNA was amplified targeting the variable region of 16S ribosomal DNA by PCR. Purified PCR products will be sequenced using MiSeq Kit on MiSeq FGx sequencing platform. Sequence data will be analyzed by mothur v1.48.5 and MiSeq to characterize bacterial community diversity. Winter collected samples revealed disparities in human DNA recovery between genders, averaging 0.048 ng/µL for females and 0.392 ng/µL for males. Average human DNA recovery was greater from male volunteers (0.690 ng/µL) than females (0.081 ng/µL). These findings will evaluate microbial transfer and stability on cartridge casings under diverse environmental conditions and assess their link of handled objects with handlers.

Ballots and Blood Pressure

Breonya Scott

Mentored by: Drew Johnson

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Hypertension is a primary risk factor for cardiovascular disease, disproportionately affecting Black Americans at higher rates. Voting and civic participation serve as key nonmedical drivers within the social determinants of health, influencing policies related to healthcare access, education, and health equity while fostering community empowerment. However, political processes during election seasons may also introduce acute stress that influences cardiovascular parameters. The purpose of this study was to evaluate the association between civic engagement, specifically voting, and immediate changes in blood pressure among young Black voters. Undergraduate students from an HBCU and a PWI were trained by nurses on standardized blood pressure protocols to assess voters before and after casting their ballot. Baseline demographic data were collected, and participants with elevated readings received primary care follow up recommendations. Paired sample t tests were performed for participants with complete pre and post voting data. Out of 215 participants, 105 met inclusion criteria (100% Black, 68.3% female, mean age 21.6 plus or minus 7.7 years). Among female participants, there was a statistically significant reduction in systolic blood pressure following voting, whereas diastolic changes were not significant. Male participants demonstrated no statistically significant changes in blood pressure post voting. In conclusion, these findings suggest a potential short term association between voting and acute systolic blood pressure reduction among young Black female voters, indicating civic participation may offer stress relieving benefits that influence cardiovascular health. Further research across diverse populations is warranted.

Gamifying Academic Progression: A Course Architecture for Mastery, Agency, and Rigorous Online Discussion

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Mentored by: Christopher Doval

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How can asynchronous online discussion be gamified without reducing academic engagement to points, badges, or superficial participation? This conceptual paper proposes a course architecture that gamifies academic progression rather than merely rewarding participation. The model uses progression, choice, flexible pathways, and increasing challenge to create an environment in which students practice academic and legal research, apply course concepts to concrete problems, and develop critical thinking through civil and structured argumentation.The model combines clear academic structure with intellectual freedom. Expectations for research, reasoning, evidence, and civil engagement remain explicit, while students retain meaningful discretion over the questions, sources, perspectives, and lines of inquiry they pursue. Structure therefore establishes standards for academic engagement without unnecessarily constraining curiosity or intellectual direction.Instructor mentorship, peer interaction, and structured choice support students as they develop greater skill and agency. Deadlines organize participation but do not serve as permanent barriers to mastery. Students who miss work or temporarily disengage retain meaningful opportunities to demonstrate learning through later substantive contributions, allowing the architecture to prioritize demonstrated competence over rigid procedural compliance.The paper develops testable propositions concerning persistence and reentry, discussion quality, revision, belonging, student agency, and faculty workload. Its central contribution is a framework for gamifying progression toward increasingly sophisticated academic performance while preserving rigor, flexibility, and meaningful student choice.

Virulence Signatures and Biofilm-Forming Capacity of ESBL-Producing Escherichia coli in Wastewater and Agricultural Environments

Monica Sellars

Mentored by: Mabel Aworh

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Escherichia coli is a key indicator of fecal contamination and a reservoir for antimicrobial resistance (AMR) and virulence genes in aquatic environments. Wastewater treatment plants (WWTPs) and livestock facilities facilitate the dissemination of resistant bacteria, presenting public health concerns.This study investigated 452 samples collected from two municipal WWTPs, a poultry farm, and a cattle farm. E. coli was isolated using culture and biochemical testing, and extended-spectrum β-lactamase (ESBL) production was confirmed. Polymerase chain reaction (PCR) detected virulence genes associated with diarrhoeagenic and extraintestinal pathotypes, and biofilm formation was assessed via the crystal violet microtiter plate assay.Of the 452 samples, 121 (26.8%) yielded confirmed ESBL-producing E. coli. Poultry farm isolates exhibited the highest virulence gene frequencies. The most prevalent genes were ompA (94.2%), traT (93.4%), fimH (86.0%), and chuA (67.8%), while eaeA was least frequent. Prevalence of traT and stx1 differed significantly by source ($p = 0.0398$ and $p = 0.0224$, respectively). Biofilm assays revealed that non-biofilm-forming isolates were most common, followed by weak, moderate, and strong biofilm producers.The high prevalence of virulence-associated, ESBL-producing E. coli in poultry and wastewater environments—coupled with their biofilm-forming abilities—underscores these settings as vital reservoirs for resistant pathogens. These findings highlight the necessity for integrated One Health surveillance strategies to curb environmental AMR dissemination.

Invisible Caregivers: Financial Policy Gaps Affecting Grandmother-Led Kinship Care in the United States

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Mentored by: Tamara Woods

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Kinship care provides children who cannot safely remain with their biological parents with family stability, cultural continuity, and stronger family relationships; however, grandmother caregivers often receive less financial assistance and fewer supportive services than licensed foster parents. This study examines how U.S. child welfare policies contribute to financial disparities between grandmother caregivers and licensed foster parents and identifies structural and administrative barriers to financial assistance, foster care licensure, and formal support services. Guided by Black Feminist Thought and Intersectionality Theory, the study uses a mixed-methods secondary data analysis of peer-reviewed literature, government reports, policy analyses, and national datasets, including AFCARS, NCANDS, and the American Community Survey. Quantitative evidence was synthesized to identify national trends in kinship care, grandparent caregiving, and financial hardship, while qualitative evidence was analyzed thematically to identify recurring policy and service barriers. Findings support all four hypotheses: grandmother caregivers receive less financial assistance, experience greater barriers to formal services, encounter significant administrative obstacles, and face increased caregiver stress associated with limited resources. The findings highlight how support tied to foster care licensure rather than caregiver need can reinforce inequities. This research contributes to social work and child welfare by identifying opportunities to reduce administrative barriers, expand equitable financial assistance and supportive services, and strengthen outcomes for kinship families.

Comparative Evaluation of Object Detection Methods on Stereoscopic Distance Estimation

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Mentored by: Amirhossein Ghasemi

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Autonomous vehicles depend on accurate obstacle detection to estimate how far away hazards are and to brake in time, yet the effect of front-end detection quality on downstream stereo distance estimation is rarely isolated. This project asks which object mask generation method produces the most accurate and robust distance-to-collision estimates in a stereoscopic vision pipeline. Stereo vision is a well-established approach to depth perception, and both classical image processing techniques and deep learning detectors are widely used to locate objects, but they are seldom compared directly within one depth estimation framework. Using MATLAB and an Intel RealSense camera, a stereo pipeline was built from camera calibration, image rectification, block-based stereo matching, disparity estimation, and depth calculation. Four detection methods, HSV thresholding, k-means spatial-color clustering, depth-based clustering, and a YOLOv4 network trained on 300 labeled images, were used to segment three obstacles: a traffic cone, a stop sign, and a traffic light. Each method's calculated distance was compared with ruler-measured ground truth. K-means clustering performed worst, with errors up to 65.6 percent, because of poor boundary definition. HSV thresholding struggled with color variance, depth-based clustering effectively suppressed background noise, and YOLOv4 was the most robust, with errors under 4 percent. These results show that weak detection software introduces cascading errors into distance estimates, which could compromise braking safety. Future work will test moving video under harsh weather and low-light conditions.

The Role of Host Genotype in the Survival of Nematostella vectensis

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Individuals of the same species can live in a variety of locations and adapt to local conditions through unique genetic differences. For example, the starlet sea anemone Nematostella vectensis is found along the east coast of the United States, where populations vary in genome content and in the number of copies of specific genes across this geographic range. However, the effects of these genetic differences on species fitness remain largely unknown. To test this, we crossed N. vectensis populations with different copy numbers of immune-related genes and exposed them to abiotic and biotic stressors to compare survival. We generated hybrids between the low-copy-number Nova Scotia population (maternal, ♀) and the high-copy-number Florida population (paternal, ♂) to test the effect of host genotype on survival. To account for differences in temperature between Nova Scotia and Florida, we compared the survival rates of the hybrids at 20 °C and 30 °C to see the organism's response to changes in temperature alone. We then exposed the Nova Scotia (♀) x Florida (♂) hybrids and Florida clones (control) to two types of bacteria: a commensal (Vibrio diabolicus) bacterium and a pathogenic (Vibrio coralliilyticus) bacterium. These groups were kept at 30°C, as V. coralliilyticus exhibits pathogenic behavior at this temperature. Survival was monitored and quantified at 24, 48, and 120 hours. These experiments allow us to investigate how host genotype affects survival under environmental stress. Understanding these genotype-phenotype relationships can provide valuable insight into the role of gene copy number in species adaptation.

Accelerating Ischemia Reperfusion Injury Drug Discovery Through Polypharmacology-Based Multi-Target Screening

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Ischemia-reperfusion injury (IRI) is one of the leading causes of mortality and long-term disability worldwide. IRI occurs after blood flow is restored to the heart muscle after a period of ischemia and accounts for over half of the damage seen after heart attacks. Blood and oxygen loss to the heart results in the collapse of Na+/K+ channels, depletion of antioxidants, and an increase in ROS factors, leading to the release of proteins and cytokines, which harm the body. This disorder entails complex interactions between multiple factors: apoptosis, inflammation, vascular dysfunction, and impaired angiogenesis. These interrelated aspects make single-target therapies ineffective. Therefore, this project aims to apply a computational pharmacology approach to identify small molecules that can simultaneously modulate multiple ischemia-associated targets. Given their central role in IRI pathology, key therapeutic proteins were selected: Caspase-3, TNF-α, ACE, and VEGFR2. A large virtual library of FDA-approved drugs and natural compounds was prepared and systematically screened using an integrated pipeline that included pharmacophore modeling, multi-stage molecular docking, MM-GBSA rescoring, and molecular dynamics simulations. Compounds were ranked by binding score to identify dual- and triple-acting molecules with optimal binding stability and drug-like properties. This study demonstrates the use of polypharmacology to capture disease complexity and accelerate therapeutic discovery through in-silico methodologies. This approach provides a scalable and cost-effective platform for developing next-generation ischemia treatments with improved efficacy and reduced adverse effects.

Avian Activity and Native Bird Species Appearance Across an Urban Canopy Cover Gradient

Drayton Severns

Mentored by: Marguerite Bishop

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Because of urbanization, tree canopy cover sees an immediate loss in presence after human developments are begun. Overtime tree canopy cover can gradually increase, but this is only with a proper approach to city planning. In cities with high amounts of building density and pavement placement there are still areas with a less tree canopy cover and than overall greenery. This has a direct impact on native bird populations as with less access to trees and grassy areas there is a reduction in species richness and activity. However, with the introduction of supplementary sources of food, such as bird feeders, which are common in urban environments, there is an increase in bird appearances compared to more rural areas with less development. The goal of this project is to examine native bird species and if they have a preference in tree canopy cover when a bird feeder is present. By locating sites on a college campus with varying amounts of tree canopy cover measured with a densiometer, multiple bird feeders will be established along with an associated trail camera for capturing 24/7 motion captured 10 second clips for data collection. Expected conclusions are that tree canopy cover has an impact on the frequency of bird appearances at a feeder and diversity of birds present.

The Relationship Between Activity State and Memory Performance in Older Adults With and Without Mild Cognitive Impairment

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Physical activity has been found to be beneficial for cognitive functioning in older adults. Mild cognitive impairment (MCI) is the disease state between normal cognitive functioning and dementia. Not much is known about the potential benefits of acute exercise for those with MCI. The current study examined cognitive abilities of 6 participants with MCI and 10 healthy controls in physically active and sedentary states. Participants completed cognitive tests through the NIH Toolbox (Rey Auditory Verbal Learning Test) after the exercise and sedentary condition. Healthy controls scored significantly better on the RAVLT than those with MCI in the sedentary condition, while the difference between groups was not significant in the exercise condition. The findings of this study suggest that cognitive performance differs between older adults with and without MCI depending on their activity state. These results indicate that sedentary states are associated with lower memory performance among older adults with MCI. However, the effects of acute exercise could vary depending on the type of exercise and cognitive outcome being measured. Future research with larger samples is needed to better understand how physical activity might affect cognitive performance in older adults with MCI.

Youth Climate Activism Shapes Local Environmental Policy and Community Engagement

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Youth engagement with environmental advocacy has gained a more prominent place in climate work. The review analyzes the impacts of youth-driven environmental activism on policy outcomes and the ways community members are changing their behavior. It examines relevant studies in peer-reviewed academic, government, and community-based literature with regard to the relationship between youth activists' engagement, public health, public participation, and local policy process development. Evidence from the literature demonstrates that youth activist contributions reinforce local climate action by providing communications that translate climate and health sciences to stimulate action in their communities and in politics. The review also highlights youth engagement examples from Asheville, North Carolina, and Portland, Oregon, which show how youth-driven action can benefit local institutions as well as community sustainability projects while exposing practical problems in the actual implementations. Limitations of the literature are addressed, which include policy, political divisiveness, inequity of resources, and difficulty in converting crowd support to policy outcomes. Nonetheless, the literature demonstrates the potential impact youth-driven initiatives can have in connecting climate and health sciences to local behavior and policy decision-making, as well as sustainable policy outcomes that rely on collective participation of all sectors of the public.

Creation of a Novel MerTK Small-Molecule Inhibitor for Use in Ewing Sarcoma Cancer Therapy

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Ewing sarcoma is a bone tumor with low survival rates for patients with metastasized and/or chemoresistant tumors. MerTK, which is overexpressed in Ewing sarcoma, is linked to increased chemoresistance, immune suppression, and a higher risk of metastasis. When the current leading small-molecule inhibitor for MerTK, MRX-2843, was tested on Ewing sarcoma, MerTK inhibition required higher doses than in other cancers; therefore, a more potent, novel, and highly selective inhibitor would be beneficial for more effective inhibition of MerTK processes. This, in turn, will lead to cancer cell death, improve immune response, and prevent cancer cell metastasis. I will use pyrrolo [2,3-d]pyrimidine, furo[2,3-d]pyrimidine, 1,2,3-triazoles, and 1,2,4-triazoles as scaffolds to create the inhibitor, from which I generated and selected a variety of designs based on properties such as synthesizability, cost, docking score, and oral bioavailability. From this process, a novel triazole derivative was identified as the top candidate for synthesis and evaluated using an IC50 assay to assess its in vitro inhibition potential.

The Impact of a Nature-based Mindfulness Practice on Undergraduate Student Outcomes

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Mentored by: Kelsey Bitting

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Undergraduate university students are facing a mental health crisis. Existing research has evaluated the role of connectedness to nature as a method of remediating negative mental health and improving positive mental health. However, not all students have equal access to the outdoors, and may face barriers to spending time in nature due to time constraints in university settings. This study explored the impact of a mindful nature-awareness practice called "sit spots" on students' connectedness to nature across five courses taught by three instructors. As a class assignment in each course, students participated in eight sit spots in an outdoor location of their choice on campus during a one-month period, journaling about each individual experience with a series of guided reflection prompts. We administered a pre-post survey using the Nature Connectedness Index and the Illustrated Inclusion of Nature in Self Scale to measure students' connectedness to nature. Additionally, the Positive and Negative Affect Scale was used to measure changes in mood, and the Mindfulness Process Questionnaire to assess mindfulness skills. Demographic questions were also used to assess variation within the population. Results of the study demonstrate overall improvements in connectedness to nature, mindfulness, and positive affect. These results suggest that the sit spot assignment may be useful in university curricula as a method of increasing student engagement with nature, prioritizing student mental health through holistic wellness in academic assignments. More broadly, sit spots can enhance pro-environmental behavior associated with mindfulness in nature, positively influencing human behavior and environmental preservation.

Herpetofauna Habitat Assessment in the South Carolina Piedmont

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Herpetofauna around the globe are declining at an alarming rate due to several factors which all ultimately are forms of habitat destruction. Understanding habitat preferences of amphibian and reptile communities is critical in managing these declining populations. During the summer of 2025, a network of artificial cover objects (ACOs) was constructed at the Carolina Wildlands Foundation (CWF) in Chesterfield County, SC to survey herpetofauna and conduct disease surveillance. The CWF is at the edge of the piedmont-sandhills fall line and hosts a mosaic of distinct plant communities, influenced by the transition between these two ecoregions and a history of varied land uses. The purpose of this study was to evaluate whether plant communities influenced herpetofauna abundance, richness and diversity across ACO sites. We measured characteristics such as tree diversity, canopy height, canopy closure, foliage height diversity (FHD), coarse woody debris (CWD) and ground cover using standard US forest service methods. Cotemporally, we performed biweekly surveillance of our ACO network to record amphibian and reptile presence. We had substantial variation between ACO sites in capture success ranging from 0.13 captures per unit effort to 0.016. Preliminary data analysis has revealed that CWD, canopy closure, and FHD may drive some of the variation in amphibian and reptile abundance and diversity. Planned data analysis and continued habitat characterization will reveal more patterns in habitat preferences of herpetofauna. Furthermore, these habitat characteristics will also be used to assess drivers of pathogen prevalence within the herpetofauna community.

Enhancing Antioxidant Activity in Green Tea Through Natural Herbal Blends

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Green tea is widely recognized for its antioxidant properties, and combining it with herbs may influence its antioxidant capacity. This study investigated the antioxidant capacity of green tea and selected herbal ingredients and examined whether blending green tea with mint, ginger, and hibiscus could enhance antioxidant capacity. Tea samples were prepared by steeping green tea leaves, dried mint leaves, ginger powder, and dried hibiscus petals in hot distilled water. Blended samples were prepared using varying proportions of green tea and the selected herbal ingredients. Antioxidant capacity was evaluated using the ferric reducing antioxidant power (FRAP) assay, with absorbance measured at 593 nm and antioxidant capacity determined using $FeSO_4$ standards. Three independent trials were conducted for each tea sample to improve measurement reliability. Among the individual herbal teas tested, mint demonstrated the highest average antioxidant capacity (12.48 μmol Fe^{2+}/g), followed by hibiscus (10.00 μmol Fe^{2+}/g) and ginger (5.79 μmol Fe^{2+}/g). These results demonstrate differences in antioxidant capacity among the tested herbal ingredients and suggest that the proportion of green tea and herbal components may influence the measured antioxidant capacity of blended teas. The findings provide a basis for further investigation of herbal combinations and preparation conditions to identify blends with enhanced antioxidant capacity.

Do Latin Roots Help Students Remember Spanish Vocabulary?

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Many Spanish and English words descend from Latin, yet vocabulary instruction rarely uses these shared roots as a memory aid. Research on elaborative encoding suggests that connecting new information to existing knowledge improves retention, but little research has tested whether teaching a word's history helps language learners when the Spanish word does not resemble its English relative. This study asks whether learning a Spanish word's Latin root, together with an English word that shares that root, improves recall compared with learning the meaning alone. In a single-participant pilot, words learned with roots were recalled at 80% on both days, compared with 50% on the first day and 70% the next day for words learned without roots. Data collection with volunteer high school Spanish students is now underway through an online platform. Each participant studies 20 low-frequency Spanish words that are not obvious cognates, such as rodilla (knee), from the Latin rotella, "little wheel," which is also the root of the English word rotate. Half of the words are shown with their root and a short explanation of the word's history, and half is switched across participants. Recall is tested immediately and after 24 hours, excluding words participants already knew, and study time is recorded for every word. We expect words learned with roots to be recalled better, especially after 24 hours. The results could support a simple, low-cost strategy for teaching Spanish vocabulary.

Comprehensive Assessment of Water Quality Parameters and Hydrochemical Dynamics in Raleigh Wetlands

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Wetlands provide essential ecological services, yet urban stormwater can alter conditions in aquatic ecosystems. This study investigated spatial and temporal variation in water quality across wetlands in the Raleigh, North Carolina region, focusing on Indian Creek Wetland in Morrisville. As a constructed stormwater-management wetland, Indian Creek contains an accessible inlet, central vegetation and aeration, and an outlet, allowing water quality to be evaluated as water moves through the system. Surface water was sampled during summer 2026 and analyzed for turbidity, nutrients, pH, conductivity, total dissolved solids (TDS), dissolved oxygen (DO), and temperature. Turbidity decreased from inlet to outlet on all three sampling dates. Following storms, turbidity decreased from 980 to 221 NTU on 07.26 and 316 to 277 NTU on 08.2. Without a recent storm, September 6 turbidity was substantially lower, decreasing from 19.1 to 4.95 NTU. Elevated post-storm turbidity and observed flooding suggest high stormwater inflows may influence sediment retention. On September 6, conductivity decreased from 181 to 142 μS/cm, TDS from 90 to 71 ppm, and DO increased from 6.71 to 8.73 mg/L between inlet and outlet. Nitrite generally decreased by 0.25 ppm, with a range of 0-0.5 ppm between inlet and outlet, consistent with nutrient retention or transformation. Higher post-storm nutrient levels coincided with surrounding construction and maintained lawns, suggesting runoff as a potential source. Frequent dragonfly activity was also observed, suggesting habitat for natural mosquito predators and a potential indirect benefit for mosquito regulation. Overall, these findings highlight the water-quality and ecological functions of constructed wetlands.

Mechanisms of Dicentric Chromosome Resolution

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Cell division is a process by which chromosomes are pulled apart into daughter cells. The structural integrity of chromosomes is vital for cell division. The centromere is an important structure because it’s where spindle fibers latch onto separate chromosomes. Chromosomes with abnormal or multiple centromeres can cause breakage, genomic instability, or cell death. A cell's ability to resolve dicentric chromosomes is crucial to preventing cancer and other diseases. However, the mechanisms by which cells restore stability after dicentric chromosome formation remain incompletely understood. This project aims to understand how cells convert dicentric chromosomes into stable monocentric ones. We cultured yeast cells and used conditional dicentric induction under different carbon sources (glucose and galactose). Specifically, we looked for deletions in the CEN3 and GalCEN regions by performing PCR on yeast DNA to test whether chromosome stabilization occurred through centromere deletion. Initial experiments used two primer sets to detect deletions. Two additional primer sets validated these deletions and ruled out primer failure or experimental error. DNA sequencing was used to determine the exact deletion boundaries, and a PCR assay was developed to distinguish homologous recombination from other DNA repair pathways. Analysis of our sequencing results showed centromere deletion events in both the CEN3 and GalCEN regions. These findings indicate that centromere loss plays an important role in the resolution of dicentric chromosomes and suggest this as the mechanism by which unstable chromosomes are resolved. These preliminary findings improve our understanding of dicentric chromosome resolution and support future studies of centromere excision.

The Patterns of M-Avoiding Integers

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Through NCSSM's Summer Research in Mathematics program, I was given the problem 12604 from the American Mathematical Monthly. The problem asks to classify all integers k that are m-avoiding, m-avoiding meaning there is no integer n greater than or equal to m^2 and less than k that satisfies either k^2<mn^2<(k+1)^2 or k^2<mn(n+1)<(k+1)^2. By creating functions that assign an n to every k integer, and then rounding that n to either nearest integer, I was able to classify m-avoiding integers for m = 2,3,4, and 5 by plugging in n as a function of k and also finding the ranges of k values that cannot be m-avoiding. A consistent pattern was found for m-avoiding integers.

Re-evaluating Food Access Across North and South Carolina

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Food access is shaped by more than income and proximity to a supermarket or grocery store. Challenges related to high food prices and uncertainty around funding of federal and state food assistance programs continue to alter food access and food environments—the physical and social locations where people buy their food—across the country. This project examines how changes in food environments, retail availability, and other socioeconomic factors across North and South Carolina influence access. Using data from the American Community Survey 2019-2023 5-year estimates from the U.S. Census Bureau, store types and location data from Data Axle (a data repository), and 2019 estimates for low-income, low-access census tracts from the U.S. Department of Agriculture datasets to re-evaluate low-income, low food access areas across both states. This is important because these designations have not been updated since 2019, one year before the COVID-19 pandemic. We first mimic the traditional evaluation approach, which considers the distance (i.e., RURAL, URBAN) of each census tract to a grocery store and the percentage of the tract population living in poverty. We then update this approach by calculating proximity to dollar stores, in addition to grocery stores, while using the same poverty threshold. The project uses Geographic Information Systems (GIS), spatial analysis, and statistical methods to examine census tract-level patterns and changes in food environments. This research is timely given ongoing costs of living for Americans around the country and across the rural-urban continuum.

Molecular Modeling Approaches to Identify Novel Natural Compound Beta-Glucuronidase Inhibitors

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β-glucuronidases (GUS) are bacterial enzymes that influence host pharmacokinetics by deconjugating glucuronidated drug metabolites formed during Phase-II drug metabolism. This process regenerates active compounds in the intestinal lumen, increasing local drug exposure which contributes to gastrointestinal toxicity, including severe diarrhea that occurs following treatment with cancer chemotherapy. Selective small-molecule GUS inhibitors have demonstrated efficacy in preclinical models by reducing drug-induced intestinal toxicity while preserving the therapeutic activity of the parent drug. However, translation of these inhibitors to clinically relevant interventions remain challenging. Natural products represent an attractive and underexplored source of GUS inhibitors, as several known GUS inhibitors belong to naturally occurring chemical classes like flavonoids and arabinitol derivatives. In our preliminary studies, we found that kombucha tea contains an organic acid found to be a potent and selective bacterial GUS inhibitor, suggesting that fermented foods may represent a contain additional bioactive compounds with GUS-modulating activity. To accelerate discovery of such compounds, we developed a computational pipeline integrating molecular dynamics simulations and quantitative structure-activity relationship (QSAR) modeling. Using this pipeline, we interrogate natural product databases and metabolomic datasets derived from traditional fermented foods like kombucha, kefir, and şalgam. Promising high-priority compounds identified through computational screening will subsequently be tested in vitro to evaluate their inhibitory activity against purified bacterial GUS enzymes, and simplified human microbiota representative of patients receiving specific chemotherapies. Ultimately, incorporating foods containing GUS inhibitors during cancer treatment may offer a practical and accessible means to enhance drug tolerability and improve patient outcomes.

Political Economy of Policing

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In the past several years, numerous stories of police misconduct have gained attention on the national stage. Notably, these cases happen all over the country, with some going to criminal trial and/or civil trial, while others are settled outside of court beforehand. Previous research on aggregate police misconduct has often been focused on individual cities or states, and has discussed the implications of repeat offenders in lawsuits with police brutality. However, the total cost of these settlements on a national scale and the distribution of the various methods to pay for them is largely unexamined. This project aims to compile aggregate data for the entire United States. Data for this project is being compiled through Freedom of Information Act and Public Records Requests to the top five most populous cities in each US state, with requests for data on police misconduct settlements during the years of 2017 to 2022. The mechanisms of how settlements were paid out are also being collected, whether they were a part of a city's budget, or if an insurance policy or some kind of risk management trust was used to pay. Using a critical theory viewpoint, the research thus far provides an exploratory view into the financial implications of police misconduct in the United States, and how it varies from state-to-state, and city-to-city. After aggregate data is fully collected, this research will be used to place the economics of policing into a broader political context, and how these trends can shape future police misconduct policy.

Evaluation of Post-Mining Land Rehabilitation Strategies in Mpumalanga, South Africa

Rokia Sissoko

Mentored by: Stephanie Norander

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Evaluating comprehensive, equitable post-mining land restoration in South Africa requires asking how technical environmental management tools can be integrated with social movement frameworks. Historic mineral exploitation has left over 6,000 abandoned mine sites across South Africa, generating severe ecological and public health threats including acid mine drainage, toxic heavy metal soil contamination, and airborne asbestos fibers that disproportionately burden nearby working-class communities. Utilizing a multi-faceted methodology, the project analyzes risk prioritization tools such as the Qualitative Ranking Tool for asbestos hazard scoring alongside a five-step ecological remediation model that combines constructed wetlands for passive acid drainage treatment with phytomining for metal recovery and soil restoration in the Mpumalanga coalfields. Environmental sampling in Mpumalanga confirmed that lead, sulphate, and water quality parameters significantly breached national safety standards. Findings reveal that technical interventions alone remain insufficient when undermined by lowest-bid procurement practices, institutional disconnects, and a lack of regulatory accountability. To achieve effective and just land rehabilitation, the proposed tripartite model balances technical remediation science, policy accountability, and community-led environmental justice goals. Ultimately, this framework contributes a vital path forward for moving beyond superficial site cleanup, demonstrating how holistic post-mining land use can mitigate severe environmental hazards, restore agricultural capacity, and promote socio-economic equity for historically marginalized communities.

INVESTIGATING VERRUCOMICROBIOTA SPECIES ABUNDANCE AS A BIOMARKER FOR EARLY DETECTION OF EQUINE GASTROINTESTINAL DYSBIOSIS

Kristian Smith

Mentored by: Carmony Hartwig

Catawba College

Equine gastrointestinal health is closely aligned with the composition and stability of the gut microbiome. Disruptions in the microbial community, known as dysbiosis, may contribute to gastrointestinal disturbances such as diarrhea, which may lead to further health complications. Early detection of gastrointestinal disturbances can be difficult, so identifying microbial indicators associated with a healthy versus an unhealthy gut microbiome prior to onset of symptoms could provide a potential noninvasive method for monitoring equine gastrointestinal health. This study aims to develop a biomarker-based diagnostic assay to detect the presence and abundance of Verrucomicrobiota in equine fecal samples. Loss of Verrucomicrobiota, found primarily within the equine hindgut, is correlated with gastrointestinal disturbance in horses, and therefore the first goal of this research is to develop a molecular method for detection of Verrucomicrobiota from a complex mixture of extracted DNA. Using protocols modified from Sangwan et al., 2005, we successfully amplified the Verrucomicrobiota-specific region of the 16S rRNA from 2 of 8 soil sample DNA extracts from our local preserve, confirmed through sequence analysis of purified PCR products. Future work will use these positive extracts as controls to develop a quantitative diagnostic PCR that will allow for detection of alterations in Verrucomicrobiota abundance as an early bioindicator of equine gut dysbiosis.

The Effect of Social Media on College Students' Well-Being

Lydia Smith

Mentored by: Ivelina Naydenova

Gardner-Webb University

The purpose of the current study is to look at the effect of using social media on young adults' sense of belonging, quality of friendships, and emotional well-being. Existing research has focused mostly on the negative effects of social media, such as increased anxiety and depression (Kales et al., 2020). However, new emerging research has shown that social media also has some potential positive effects when it comes to reducing loneliness in college students (Hall & Sharabi, 2025). Thirty-eight students from a small private university gathered via convenience sampling participated in the current study. The participants completed a battery of tests including Satisfaction with Life Scale (Diener, et al., 1985), a Need to Belong scale (Baumeister & Leary, 1995), a Quality of Friendship Scale (Bukowski et al., 1994), and a Loneliness Scale (Russell,1996). Consistent with our hypotheses, the current study found that the use of social media was positively correlated with need to belong (r=. 48, p < . 01). Furthermore, the pattern of results suggested that the use of social media is positively correlated with quality of friendships (r = . 3, p < .05) and the use of social media is negatively correlated with loneliness (r= -.56, p < .01). Our study had some notable limitations. These include restriction of range among participants for quality of friendships and relationship satisfaction scores. This study is still ongoing. Further research is needed to clarify the associations between use of social media and need to belong and quality of friendships.

Beyond Seasonal Spikes: Assessing Geographic Ozone Vulnerability and Critical Care Outcomes in Youth Asthma Exacerbations

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Background: Youth asthma exacerbations are highly sensitive to ambient environmental fluctuations. While standard public health outreach utilizes the Air Quality Index (AQI) to advise exposure reduction during seasonal peak windows, the chronic, year-round impact of ground-level ozone (O3) exposure and geographic ozone vulnerability remains an under-explored determinant of critical care severity in youth. Objectives & Specific Aims: To evaluate the year-round associations between geographic ozone exposure, ozone vulnerability, and clinical outcomes in youth admitted to the pediatric intensive care unit (PICU) for acute asthma. Research Design & Methods: A retrospective cohort study was conducted on youth (n = 213) admitted to the PICU for acute asthma exacerbation between January 1, 2022, and December 31, 2024. PICU admission acuity was measured using the Pediatric Risk of Mortality III Risk of Mortality (PRISM_3_ROM) score, and healthcare resource utilization was assessed via PICU length of stay (LOS). Residential zip codes were mapped to the CDC/ATSDR Environmental Justice Index (EJI) to extract two primary continuous independent variables in a consistent logical order: raw ozone concentration metrics (E_ozone) and ozone vulnerability percentile rankings (EPL_ozone). Continuous data were modeled across all seasons to estimate year-round baseline associations. Data & Analysis: Scatter plots and correlation matrices were utilized within a linear regression framework to estimate primary associations. E_ozone and EPL_ozone demonstrated a strong, direct baseline correlation, verifying geographic exposure consistency. When evaluated against clinical outcomes, both raw ozone metrics (E_ozone) and ozone vulnerability percentiles (EPL_ozone) demonstrated positive linear associations with PICU length of stay (LOS). Conversely, associations between both ozone metrics and acute physiological distress at admission (PRISM_3_ROM) remained relatively flat across the cohort. Results & Conclusions: Utilizing year-round, multi-year datasets allows for a more comprehensive understanding of how chronic environmental risk factors dictate youth asthma severity. The positive association with LOS suggests that chronic background ozone exposure and localized vulnerability are associated with longer recovery times and prolonged PICU resource utilization, even when initial admission severity is unchanged. These findings underscore that ambient ozone exposure and regional environmental vulnerability pose a persistent, year-round public health challenge requiring continuous clinical and structural intervention. Resources1. Lin S, Liu X, Le LH, Hwang SA. Chronic exposure to ambient ozone and asthma hospital admissions among children. Environ Health Perspect. 2008 Dec;116(12):1725-30. doi: 10.1289/ehp.11184. Epub 2008 Sep 10. PMID: 19079727; PMCID: PMC2599770.2. United States Environmental Protection Agency (EPA) (2026) Patient Exposure and the Air Quality Index EPA Patient Exposure and Air Quality Index Page3. Atkinson CE, Kesic MJ, Hernandez ML. Ozone in the Development of Pediatric Asthma and Atopic Disease. Immunol Allergy Clin North Am. 2022 Nov;42(4):701-713. doi: 10.1016/j.iac.2022.06.001. Epub 2022 Sep 23. PMID: 36265970; PMCID: PMC10519373

Human Activity Recognition Using mmWave Wireless Signals and Deep Learning

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Camera-based human activity recognition raises significant privacy concerns because it requires capturing and often storing continuous video of individuals. Millimeter-wave (mmWave) radar offers a privacy-preserving alternative by sensing motion through radio-frequency reflections and measuring range, velocity, and angle without recording identifiable images. This project investigates whether a frozen, pretrained radar encoder from mmCLIP, a lab-developed model inspired by the CLIP vision-language architecture, can be paired with a lightweight trainable classifier head to accurately recognize human activities without retraining the backbone. Radar data were collected using an IWR1843 sensor with a DCA1000 capture card at a subject-to-radar distance of approximately 3.24 meters in an indoor lab setting, with two participants. Raw signals were converted into Time-Doppler, Time-Range, and Time-Angle heatmaps and passed through the frozen encoder to extract features. These features were then used to train a classifier through linear probing on seven activity classes: jumping, kicking, hand waving, standing still, side walking, punching, and head nodding. The classifier achieved 100% held-out validation accuracy at both segment and trial levels. A complete live sensing pipeline was then deployed on physical hardware, initially revealing a domain gap caused by preprocessing inconsistencies in a new environment. Retraining only the classifier head resolved this issue, restoring near-perfect live accuracy, with predictions reaching 99.9% confidence. These findings demonstrate that efficient transfer learning with frozen radar features can support practical, camera-free activity recognition systems for elder care, smart-home automation, and privacy-conscious health monitoring, while identifying inference latency as the primary remaining barrier to fully real-time deployment.

Emotional Induction, Recognition Memory, and Anxiety Among Adults

Jasmine Snowden

Mentored by: Kulwinder Kaur-Walker

Elizabeth City State University

Emotional experiences may influence how people process and remember information. This ongoing study examines whether exposure to disturbing content before reading is associated with poorer recognition memory than reading the same content or viewing an enjoyable clip. To date, 50 adults have been randomly assigned to one of three approximately five-minute activities: watching a disturbing video about U.S. crime facts, reading a transcript of that video alone, or watching a fun clip. Participants then read a passage, completed a recognition assessment scored by the number of correct answers, and reported anxiety and difficulties in emotion regulation. Contrary to the hypothesis, recognition scores were highest in the disturbing-video group ($M = 6.60$, $SD = 2.87$), followed by the transcript group ($M = 5.18$, $SD = 2.35$) and fun-clip group ($M = 4.61$, $SD = 2.03$). However, the overall difference was not statistically significant, $F(2, 47) = 2.88$, $p = .066$. Anxiety scores differed across groups, $F(2, 47) = 17.00$, $p < .001$, and were lowest in the fun-clip group ($M = 15.17$, $SD = 2.50$). Difficulties-in-emotion-regulation scores also differed, $F(2, 47) = 5.14$, $p = .010$. These preliminary results do not support the predicted impairment in recognition memory. Analyses will be updated as data collection continues.

Natives Land Act of 1913 Impact on Production and Spatial Geography of Pearl Millet in Post-Apartheid South Africa

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This analytical literature review explores how the Natives Land Act of 1913 shaped cultural, economic and spatial changes for pearl millet production in South Africa, particularly during the few years following 1913 and the 1994 post-Apartheid period. The Natives Land Act of 1913 restricted Black individuals from owning farmland and would be the foundation for the forced displacement of millions of Black South Africans to “Bantustans”, or regions divided by the government based on racist beliefs. Prior research has shown that pearl millet contains high nutritional value and potential for drought-resistant crop yield in areas with low soil fertility, making it a valuable food source for communities in KwaZulu-Natal, Limpopo and Free State. However, pearl millet has seen a significant decrease in farmland hectarage, production and consumption since the 1900s. Furthermore, there are significant research gaps in the quantification of pearl millet production and specific legal and spatial barriers for pearl millet production following the Natives Land Act of 1913. This review identified that the Natives Land Act maintained a racial hierarchy that dispossessed millions of Black South Africans of arable land and cultural education surrounding pearl millet production that exacerbated post-apartheid. The decrease in production and hectare for pearl millet is consistent with other indigenous grains in subsistence farming and commercial markets. This research highlights the need for reformed land policies that contextualize legacies of apartheid in grain networks for arid areas.

Beyond the Culture: Molecular Detection Reveals Widespread Carbapenem Resistance Gene Presence in Hospital Sink Plumbing

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Healthcare sinks and their associated plumbing are recognized reservoirs for clinically important pathogens, notably carbapenem-resistant Enterobacterales (CRE). Of particular concern, sink plumbing supports complex microbial communities and biofilms that may facilitate horizontal transfer of carbapenem-resistance genes (CRGs) between bacterial hosts. Thus, clinically important resistance genes may be present within sink plumbing even when CRE are not recovered by culture. By comparing culture and molecular based surveillance in parallel of this environment, this study aims to assess if there are more CRGs than detected by culture alone. Samples were collected from the P-trap and tailpipe of hospital sinks in Duke University Hospital. Samples were then processed via culture for CRE and qPCR for CRGs. From 59 sinks qPCR found CRGs in 54 sampling events while CRE recovered by culture were only present in 2 sampling events. These results reflect a substantial reservoir of carbapenem-resistant determinants not previously recognized. Detection of CRGs represents that most sinks could be colonized with CRGs that aren't in a CRE yet. Future longitudinal studies incorporating bacterial host identification and assessment of gene mobility are needed to determine the clinical relevance of this reservoir and its potential contribution to antimicrobial resistance transmission.

Creativity and Art Expression in Charlotte

Eduardo Soto

Mentored by: Cindy Gilson

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Throughout Charlotte you can see the expression of creativity in art everywhere. However, what does any of it mean, what qualifies as art; the answer lies in the art itself. The literature indicates how important street art really is to the city of not only Charlotte but to the general public. Art is not only something important but it is a way of expression, freedom and even life itself. As well the literature provides insights on what art does for the people. What does street art mean in the city of Charlotte? What benefits does it give to society and how does it give a voice to the people who do it? To answer my inquiry question, I plan on doing extensive research on what art really is and how it affects the real world attempting to truly understand the fundamental meaning to art. To observe creativity in the real-world, I will visit various art museums around Charlotte as well as graffiti areas in Charlotte as these are the best ways to see how important art is with messages spread all over. This project is still in progress; however, I anticipate that the answer to my inquiry question will likely be finding meaning in art whether it be vocally, visually, or audibly. No matter how it is seen meaning will found in art . In conclusion this project will benefit people who wish to see meaning behind art.

Impulse By Design

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Impulsive behavior across retail environments often occurs without premeditation and may be shaped by emotional responses, marketing stimuli, and social pressures (Fayyaz et al., 2025). Although prior research has explored impulsive buying in isolated contexts, limited work has compared how these variables interact across both traditional retail and second-hand platforms. To address this gap, 58 adults were recruited through word-of-mouth and social media to complete an online survey assessing impulsivity across four imagery-based shopping situations: in-person retail (IRL), online retail (ORL), in-person resale (IRE), and online resale (ORE). The sample consisted mostly of young adults aged 18–28, with women representing the majority. Impulsivity was measured using items adapted from Uygur's (2018) impulsive buying scale, modified to reflect each shopping context. Descriptive results indicated that participants shopped most frequently in in-person retail settings (M = 2.043), followed by online retail (M = 1.974) and in-person resale (M = 1.944), with online resale being the least frequent (M = 1.761), aligning with the initial prediction that online resale would show the lowest impulsivity scores. All four shopping contexts were positively correlated, with relationships ranging from moderate (e.g., ORL–IRL, r = .44) to strong (e.g., ORE–IRE, r = .76), suggesting that individuals who shop more in one setting tend to shop more across others. These findings indicate that impulsive shopping tendencies may reflect a general behavioral pattern rather than being tied to a specific shopping modality or shopping type. Understanding how modality and shopping type jointly relate to impulsivity may inform consumer-behavior research, marketing strategies, and the design of both retail and resale platforms, particularly as shopping environments continue to diversify across digital and physical spaces.

Lake Norman Water Quality During Drought and Over 20 Years: A Spatiotemporal Analysis

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Mentored by: John Paul Balmonte

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Water quality within freshwater environments, such as Lake Norman in North Carolina, is critical for aquatic organisms and surrounding communities, but water physicochemical parameters may vary during periods of drought. Due to environmental change, the length and intensity of droughts are expected to increase over time, but studies are limited on changes in the physicochemical parameters of Lake Norman during periods of drought. Here, we measured temperature, dissolved oxygen, pH, specific conductivity, total dissolved solids (TDS), and nitrate + nitrite at four sites within the periphery of Lake Norman at daily-to-weekly resolution from July to September 2026, a period during which Lake Norman experienced drought conditions. In addition, we analyzed historical data spanning 5 distinct years over two decades (2002-2022) and compared our physicochemical measurements to the historical data to test whether these parameters differed during a drought period. Our results show that across all four sites, the median water temperature and TDS values were significantly higher compared to values from the 2002-2022 datasets. In contrast, dissolved oxygen concentrations were lower compared to the historical values. pH and specific conductivity values were within the range of historical values and did not differ significantly. Thus, periods of drought appear to have the most substantial impacts on water temperature, TDS, and dissolved oxygen, likely a consequence of abiotic and biotic factors that are impacted by limited precipitation. Sustained monitoring of Lake Norman would be advantageous to ensure optimal water quality for aquatic organisms and surrounding communities.

Relationships Among Feelings of Imposter Syndrome, Negative Self-Concept, Workaholism, and Organizational Citizenship Behaviors

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Meredith College

Imposter syndrome is a psychological experience characterized by feelings of self-doubt, inadequacy, and difficulty in feeling a sense of accomplishment (Pákozdy et al., 2024). Many employees across different professions, particularly in high-stress and competitive workplaces, struggle with imposter syndrome. The prevalence of imposter syndrome in the workplace is concerning because, over time, experiencing imposter syndrome can have a negative impact on important organizational outcomes. Research suggests that there is a relationship between negative self-concept and the experience of imposter syndrome (Mir & Kamal, 2018). However, there is not enough information regarding how imposter syndrome relates to the multiple dimensions of workaholism (e.g., motivational, cognitive, emotional, and behavioral) and no research has been conducted on a direct relationship between imposter syndrome and organizational citizenship behaviors. This study will address the gap in information by testing whether imposter syndrome predicts negative self-concept, organizational citizenship behavior, and the four types of workaholism. A sample of participants aged 18 years and older with prior experience working in a job will answer a survey with questions from the Clance Imposter Phenomenon Scale, the Robson Self-Concept Questionnaire, the Multidimensional Workaholism Scale, and the Organizational Citizenship Behavior Checklist. Hypotheses will be analyzed using descriptive statistics, correlations, and regression analyses. This study will provide insight regarding the ways imposter syndrome manifests in the workplace, which can be useful in efforts to improve employee well-being.

Evaluating the Effects of Thumb Joint Immobilization on Hand Function

Justin States

Mentored by: Dustin Crouch

North Carolina A&T State University

Scientists have developed an implantable thumb prosthesis, the EndoThumb, that is anchored to the residual bone to restore hand function after traumatic thumb amputation. The current design does not include movable metacarpophalangeal (MCP) or interphalangeal (IP) joints, similar to thumb arthrodesis, in which these joints are surgically fused. Previous studies have examined splint immobilization of either the MCP or IP joint in healthy individuals, but the combined immobilization of both joints is less well understood. The purpose of this project is to design an experimental protocol to evaluate the effect of thumb joint immobilization on hand function and to better understand the functional impact of the current prosthetic design. The protocol uses a custom thumb splint that restricts the MCP and IP joints at a prescribed angle while preserving motion of the remaining fingers. Participants will perform functional tasks under normal and thumb-immobilized conditions while motion capture and surface electromyography (EMG) data are recorded. Data will be processed in MATLAB, and an OpenSim musculoskeletal model will be developed for each condition. Kinematic and muscle activation outcomes will then be compared between the two conditions. Preliminary work with a simple task has shown that this measurement and analysis pipeline is feasible. Remaining steps include finalizing the splint and collecting experimental data. This work will provide quantitative biomechanical evidence to inform future prosthetic design.

Investigation on the Genetic Causes of Rapid Endogenous Retrovirus Expansion in CC015 Collaborative Cross Mice

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The Collaborative Cross (CC) is a panel of genetically diverse inbred mouse strains designed to provide a platform for systems genetics research. Maintaining genetic quality control across CC strains is vital for scientific rigor and reproducibility. One CC strain, CC015/Unc, has developed one or more uncharacterized mutations that allow the expansion of two endogenous retroviruses (ERVs), MuLV and RLTR4. ERVs threaten the genomic integrity of the strain by copying themselves throughout the genome. This project aims to characterize the mutation(s) in CC015 and uncover what allows the activation of ERVs. The mutation(s) will be studied using a breeding scheme between CC015 and another strain, NOD/MrkTac. The progeny from the breeding scheme will be genotyped with MiniMUGA and phenotyped using a bioinformatic pipeline that detects ERV expansion. We expect to generate a quantitative trait locus map that identifies genomic intervals likely to contain the causal variant(s). While previous studies have only established that there is at least one mutation, this study aims to characterize the location of the mutation(s) and how they are inherited. This research will provide insight into the necessary components of ERV replication, which remain poorly understood. It will also provide crucial information to determine the method that must be used to eliminate the mutation(s) from CC015 and restore the genetic integrity of the Collaborative Cross.

Effects of Urban Canopy Cover on Avian Activity and Species Diversity

Brooklynn Stewart

Mentored by: Marguerite Bishop

Gaston College

Urbanization alters bird habitats by disrupting natural vegetation and changing food availability. Canopy density may influence how birds use urban environments and the diversity of species present. However, knowledge gaps exist in how bird populations respond to habitat characteristics in urban environments. This study will investigate whether canopy density is associated with differences in bird activity and species diversity in urban environments following the introduction of a food source within differing percentages of canopy cover. To accomplish these objectives, eight hopper bird feeders will be placed with game cameras in areas located within varying percentages of canopy density. Half of the feeders will be placed in areas with lower percentages, and the other half in areas with higher percentages. The game cameras will record 24/7 motion-captured 10-second clips of the feeders, allowing bird activity and species diversity to be measured. A densiometer will be used to determine the percentage of canopy density surrounding each feeder location. Species diversity will be assessed by identifying the different bird species recorded at each feeder. It is expected that canopy density is associated with bird activity and species diversity in urban habitats. These findings may contribute to a better understanding of how birds utilize urban environments and provide information to support conservation efforts.

Site-specific protein constructs to interrogate posttranslational modifications on copper metallochaperone proteins

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Copper is an important metal ion that is vital to cellular function. It is known to support cell signaling, redox balance, and enzyme activity. Copper metallochaperones are specialized proteins that safely bind and shuttle copper ions to specific target cuproproteins via direct protein-protein interactions. Copper chaperone for superoxide dismutase (CCS) is a metallochaperone that delivers copper to Superoxide Dismutase (SOD1), a protein that detoxifies radical oxygen species. Antioxidant 1 Copper Chaperone (ATOX1) is a metallo chaperone that delivers copper to ATP 7A/B, and is known to operate as a transcription factor and assist in DNA damage repair. Both CCS and ATOX1 are posttranslationally modified; a serine 245 phosphorylation and lysine 60 acetylation respectively. The occurrence of these modifications are well documented, but their impact, and therefore biological purposes, is unknown. To perform biochemical studies to understand the effects of these posttranslational modifications (PTMs), we have employed biochemical and protein chemical strategies to obtain site-specifically modified protein constructs that contain either the native PTMs or genetically encoded PTM mimetic mutations.. Once created, these mutants will be used to carry out in vitro biochemical assays to attempt to determine the effects, and therefore the biological purpose, of the PTMs that CCS and ATOX1 undergo.

Evaluation of Elicit AI's Ability to Replicate a Published Meta-Analysis

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Elicit is a research tool that can facilitate systematic research reviews, including meta-analytic reviews, allowing researchers to allocate more time to cognitively demanding tasks within the meta-analytic workflow. Elicit reduced the time coders needed to make inclusion/exclusion decision by 20.6% (Iselin et al., 2025). With expert prompt engineering, Elicit was accurate in extracting effect sizes from seven sematic reviews in the life and environmental sciences over 87% of the time (Lagisz et al., 2026). The purpose of this study is to determine how well Elicit replicates two key stages of a published meta-analysis (i.e., Beliveau et al., 2023). First, how well do Elicit-derived prompts perform compared to researcher-derived prompts in the context of study screening criteria in the inclusion/exclusion stage? Second, how well do Elicit-derived prompts perform compared to researcher-derived prompts in the context of replicating human coding of data extraction of effect sizes and moderator variables? For study screening criteria, we will compare decision making accuracy metrics (e.g., sensitivity, specificity, positive predictive value, and negative predictive value). For data extraction, we will compare effect sizes and moderator variables from (Beliveau et al., 2023) to those from Elicit. We will also compare the percent of studies Elicit was able to extract effect sizes and moderator variables from. There are limitations in AI; therefore, it is critical that more studies evaluate Elicit within additional research domains to further establish the guidelines of their use in augmenting the systematic review process (Bernard et al., 2025).

Development of an Electroconductive Chitosan–Alginate Hydrogel Film for Biosensing Applications

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Wearable biosensors require materials that combine flexibility, biocompatibility, and electrical conductivity to enable noninvasive physiological monitoring. Previous research has demonstrated the use of conductive polymers, particularly polyaniline, in electrochemical biosensing applications due to their electrical conductivity and electrochemical activity. Building on this research, this study investigates the development and characterization of electroconductive chitosan-alginate hydrogel films for potential surface-level biosensing applications. Chitosan-alginate hydrogel films were fabricated and modified with conductive polymers through in situ polymerization of aniline and pyrrole under varying polymerization conditions. Hydrogel films were characterized through swelling analysis in phosphate buffer solution, pH stability testing, Fourier-transform infrared (FTIR) spectroscopy, and electrochemical characterization. Electrochemical characterization techniques included open-circuit potential, cyclic voltammetry, linear sweep voltammetry, electrochemical impedance spectroscopy, and Tafel analysis to evaluate the electrical and electrochemical behavior of the conductive hydrogel films. Swelling analysis demonstrated the hydrogel's ability to take up fluid, while pH testing indicated structural stability across tested conditions. FTIR analysis supported the incorporation of polyaniline within the chitosan-alginate matrix. Preliminary electrochemical characterization demonstrated differences in the electrical and electrochemical behavior of the modified hydrogel films, providing a basis for further optimization of the conductive polymers. These findings establish a foundation for the exploration of continued optimization of electroconductive hydrogels and support their potential application in flexible, noninvasive biosensing applications.

Electrification of the Rural South

Jude Stumpf

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This project asks how rural electric cooperatives reshaped the political, economic, and social life of the South and whether the model still works today. Since the New Deal, cooperatives financed through the Rural Electrification Administration have given rural Southerners ownership of a utility the private market refused to build them. Scholars have shown that electrification raised farm productivity, eased domestic labor, and drew fierce resistance from private utilities; however, far less work treats the cooperative as the living political institution it is. To address that gap, I draw on peer-reviewed literature, media coverage, oral history interviews from the Southern Oral History Program at UNC Chapel Hill, and records of cooperative expansion and financial performance. I argue that the cooperative is a progressive institution in practice, built on member ownership, elected boards, and service at cost, and that it has thrived in a conservative region for over eighty years. I expect the records to show steady expansion and sound finances, and the oral histories to show a civic capacity no other rural institution produced. I also expect to find that race, gender, and class limited who governed; those limits are a true flaw, but they do not erase what the model delivered. The project offers evidence that democratic ownership of essential infrastructure can work in conservative rural places, and it draws lessons for other public institutions.

Experiments on the Structural Response of a Transonic Truss Braced Wing

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The Transonic Truss Braced Wing (TTBW) configuration enhances commercial aircraft fuel efficiency and reduces aerodynamic drag through ultra-high aspect ratio wings supported by external braces. However, experimental data evaluating physical structural and aeroelastic responses under loading remain limited compared to computational aerodynamic studies. This study hypothesized that TTBW structures utilizing shorter brace to wing length ratios, wider brace geometries, and higher elastic modulus materials would significantly reduce wing tip deflection and enhance structural stability. A three phase computational and experimental methodology is being conducted. First, finite element analysis (FEA) using ANSYS modeled wing tip deflection under 0-120g static loads across various bracing geometries and material properties. Second, physical TTBW models are constructed using FEA-optimized parameters and structurally tested under incremental static loading (0-120g) via a custom Atwood machine setup. Third, physical deflection data is compiled and statistically compared with FEA predictions to assess model accuracy. Results are expected to confirm that higher material stiffness and shorter brace to wing length ratios will substantially minimize wing tip deflection. Physical experimental trends are expected to closely align with ANSYS computational models and validate FEA reliability for TTBW optimization. These findings will offer key experimental insights and structural guidelines for optimizing material selection and brace geometry in future high-efficiency aircraft designs.

Electrode Design and Mechanical Deformation Effects in Laser-Induced Graphene Electric Double-Layer Supercapacitors

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Supercapacitors are attractive for flexible electronics because they can store and deliver energy quickly while maintaining long cycle lifetimes. As wearable devices, soft robotics, and other flexible technologies become more common, there is growing interest in energy storage systems that are lightweight, low-cost, and able to operate under mechanical deformation. However, making supercapacitors both small and flexible introduces challenges, since electrode geometry and bending can influence ion transport and electrical performance.This project investigates flexible laser-induced graphene (LIG) electric double-layer micro-supercapacitors fabricated on polyimide using a low-cost 455 nm diode laser. I hypothesize that electrode geometries with greater edge density and shorter ion transport pathways will exhibit higher capacitance, while bending and twisting will produce relatively small changes in capacitance and resistance. Devices are characterized using resistor-capacitor (RC) discharge measurements to determine their electrical behavior. Initial fabrication experiments identified laser-processing conditions that produced relatively consistent conductive LIG, while improvements to electrical contacts and electrolyte containment increased device reliability. Ongoing experiments compare different electrode geometries and mechanical deformations to connect the physical structure of the electrodes to their electrical performance. This work aims to develop simple design principles for low-cost, flexible supercapacitors and improve understanding of how electrode structure affects energy storage in flexible devices.

Genotyping of Preclinical Mouse Models for the Experimentation of Chronic Primary Pain Conditions

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Chronic Primary Pain Conditions (CPPCs) affect over 60 million people in the US every year, predominantly women. The origins of CPPCs is linked to heightened catecholamine tone, resulting from interactions between genetic (COMT) and environmental factors (stress). Variants in the gene-encoding catecholamine-O-methyl-transferase (COMT) that result in the low activity of the enzyme that metabolizes catecholamines such as epinephrine and norepinephrine, are associated with increased CPPC risk. The impact of COMT genotype on CPPC risk is greater in individuals with high stress, which potentiates catecholamine release. Based on this evidence, we developed a pre-clinical model of CPPCs to test mechanisms that utilizes COMT +/- mice. Using this model, we identified the adrenergic receptor beta-3 (Adrb3) as a key driver of primary pain. To directly test the role of Adrb3, we developed Adrb3 knockout mice. Thus, this experiment's purpose is to genotype new female mouse litters (as CPPCs predominantly affect females) to identify ideal (heterozygous) allele pairings for chronic pain studies. Genotyping methodology includes ear-punching the mice to obtain a tissue sample, and then using standard PCR with a positive and negative control for each strain (COMT, Adrb3), along with gel electrophoresis to compare base pairs and assign the breed as homozygous, heterozygous, or wild type. Gel analysis has repeatedly shown desired results; for example, litter 618 has two heterozygotes (male) for the COMT line, and litter 682 has all four heterozygotes (female) in the Adrb3 line. Successfully isolating these female heterozygote models provides the preclinical foundation to develop female-oriented therapeutics for CPPCs.

Building an EV Battery Life Measurement System for Battery Repurposing

Aiden Sugg, Andrew Day

Mentored by: Jason Yao

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When the batteries that power hybrid and electric vehicles (EVs) have degraded beyond their ability to power their vehicles, they are often disposed of or recycled with significant usable capacity remaining. This research seeks to develop a test-bed which can determine the status of health of used electric and hybrid batteries by recording spatial data from the battery during a load test. The spatial data, such as operating voltage, current, and temperature, may be used to determine the health of the overall battery and its internal components. For example, the hybrid battery pack used by the 2nd gen Toyota Prius is composed of 28 battery modules that each contain 6 battery cells. Testing the battery pack traditionally would require testing each individual module and then finding the deficient cell(s) inside the faulty module. This research is significant because its findings will allow for faster, scalable, and standardized testing of used hybrid and electric vehicle batteries, which can provide important services as part of a “second life”. As part of their second life, hybrid and EV batteries can provide a cheaper source of energy storage for a variety of use cases. Small scale micro-grid structures such as solar farms or off grid housing may utilize them as their primary power storage device. Alternatively, data centers and other large scale infrastructures can utilize them to maintain uninterrupted service to their customer base.

Structural Barriers to Anxiety Care Among Rural African American Youth: A Biopsychosocial Review

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Anxiety disorders are among the most common mental health conditions affecting adolescents, yet early identification and treatment remain limited in rural communities. Using the biopsychosocial model, this literature review examines how structural barriers contribute to delayed identification and treatment of anxiety disorders among rural African American early adolescents ages 10-15. Peer-reviewed literature examining adolescent anxiety, biopsychosocial factors, mental health access in rural areas, and structural barriers was synthesized to identify major themes related to anxiety care in this population. Existing evidence suggests that anxiety disorders are often underrecognized and undertreated due to limited access to mental health services, underrecognition by caregivers and professionals, systemic racism, community stigma, and historical mistrust. Findings also demonstrate that biological factors such as genetics and family history, psychological factors such as minority stress and emotional regulation, and social factors such as family, school, and community interact with structural barriers to influence anxiety and access to mental health care. Evidence further supports school-based services, telehealth, and Cognitive Behavioral Therapy (CBT) as approaches that may improve access to anxiety treatment. The contribution of this review is to highlight the importance of applying a biopsychosocial framework to understanding these interconnected factors and to support timely, equitable, and culturally responsive mental health care for rural African American youth.

Development of a Portable Gas Chromatography Platform for Human Breath Analysis

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Mentored by: Vladimir Dobrokhotov

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Volatile organic compounds (VOCs) in human breath have been investigated as potential indicators of physiological processes and disease-related changes, creating opportunities for noninvasive chemical analysis. However, conventional gas chromatography (GC) instruments used to identify and quantify VOCs are generally laboratory-based and are not readily suited for portable measurements. This project investigates whether a compact, battery-powered GC platform can be used to separate and detect selected VOCs relevant to human breath analysis. The research is focused initially on compounds including acetone, ammonia, and sulfur-containing VOCs. The student researchers prepare chemical standards, develop sampling and measurement procedures,operate the portable GC system, and analyze chromatographic data to characterize the response to target compounds. Experiments evaluate the system's ability to distinguish target VOCs and establish baseline analytical performance, including retention behavior, detection response, and measurement repeatability. We expect these experiments to demonstrate the feasibility of using a compact GC platform for quantitative analysis of selected breath-related VOCs and to identify technical challenges that must be addressed for future breath-sampling studies. This work contributes to the development of portable analytical technologies that could eventually support noninvasive chemical characterization of human health. The project also provides undergraduate research experience in analytical instrumentation, chemical sensing, experimental design, and data analysis at the intersection of physics, materials science, and biomedical research.

Changes in Intermuscular Coherence Between Plantar Intrinsic and Plantarflexor Muscles During Prolonged Walking

Snehal Swain

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Prolonged walking requires coordinated activation of muscles that contribute to propulsion, foot stiffness, and force transmission. Plantar intrinsic muscles (PIMs) contribute to regulation of the medial longitudinal arch during locomotion, yet it is unclear how their neural coordination with the ankle plantarflexors changes during prolonged walking. Intermuscular coherence (IMC) quantifies shared rhythmic muscle excitation and can provide insight into common neural drive and muscle coordination. Previous research has demonstrated IMC among ankle plantarflexors during walking and changes in IMC with task demands, neurological impairment, and experimentally induced fatigue; however, less is known about IMC between PIMs and plantarflexors during prolonged walking. The purpose of this study was to investigate temporal changes in IMC between a PIM and the ankle plantarflexors during a 30-minute walking task. Fine-wire electromyography (EMG) recorded muscle excitation from a PIM, while surface EMG recorded muscle excitation from the plantarflexors and dorsiflexors. EMG signals were processed to calculate pairwise IMC across relevant frequency bands, with coherence examined across successive periods of the walking trial. We hypothesized that IMC between the PIM and plantarflexors would decrease over the course of prolonged walking, reflecting a reduction in common neural drive and coordinated muscle excitation. These findings may clarify how neural coordination between intrinsic foot muscles and ankle plantarflexors changes during prolonged locomotion, providing insight into how neuromuscular coordination of the foot and ankle is maintained or altered during prolonged walking.

A Moth Bucket List: A Survey of Nocturnal Lepidopterans in the North Carolina Piedmont

Baydn Sweatt

Mentored by: Joseph Poston

Catawba College

Worldwide, insect populations are experiencing a concerning decline due to a multitude of anthropogenic stressors. Research primarily focuses on insect orders such as Coleoptera, Hymenoptera, and Diptera, with most Lepidopteran studies focusing on butterflies. This study will evaluate the biodiversity of nocturnal Lepidopterans (moths) in the Fred Stanback Jr. Ecological Preserve (FSJEP) at Catawba College. Moths are pollinators and contribute a significant amount of biomass. It is expected that habitat type and seasonality will play a role in nocturnal lepidopteran species composition. During a preliminary study from September 2025 - August 2026, 1-3 sites within the FSJEP were surveyed using sheet traps and UV lights. Since August 21st, I started a new survey method utilizing bucket traps placed among 6 sites, divided between 3 habitat types (swamp, early successional, and mature forest), and surveyed once a week. Since the start of the survey, I have surveyed 17 nights. During the surveys I have documented 911 moths and 243 species. Observations will be uploaded to iNaturalist, and data will be analyzed using a non-metric dimensional scaling (NMDS) ordination analysis. NMDS compares habitats for similar or dissimilar species assemblages. A biodiversity survey can help provide an understanding of how habitat age and plant species diversity may influence the species assemblages of moths as a landscape ages and changes, and what species may be more sensitive to landscape changes in the future.

Insufficiencies of the Boids Model in Describing Starling Separation Events

Will Swinford

Mentored by: Tyson Hedrick

North Carolina School of Science and Mathematics

In murmurations, European starlings exhibit mesmerizing flocking behaviors, forming a collective body composed of up to a million individuals. Craig Reynolds' Boids model illustrates murmurations in flight quite successfully, relying on three fundamental rules dependent on an individual's closest neighbors: cohesion maintaining flock integrity, separation preventing collision, and alignment, which ensures similar average direction (Reynolds 1987). However, when employed, these laws struggle in mapping patterns observed during separation events, where the main flocking body splits. This project seeks to highlight such insufficiencies by determining if starlings reveal an intermingled group split that is inconsistent with Boids interaction rules. To accomplish this, a murmuration of ~2000 starlings was recorded using three GoPros. Birds were tracked across time at a confirmed separation in each camera view. These 2D trajectories were then composited to source 3D coordinates of each bird, which were manipulated in MATLAB to create relevant plots. The data suggests that cohesion and alignment are not completely decisive factors in predicting the final position of individuals. It was found that original position had little correlation to final direction; 24.56% of birds take paths unique to their nearest neighbor, refuting the objective importance of a starling's immediate vicinity in determining behavior. Revealing the limitations of a widely used ruleset, this study reflects on the accuracy of other models utilizing Boids. However, data is derived from observations of a single flock during one event and may not be representative of every member of the species, providing room to grow.

Effects of Hydrogen Peroxide-Induced Oxidative Stress and Keratin Treatment on Cellular Recycling Pathways in HEK293 Cells

Kaitlyn Tahquette

Mentored by: Heather B. Coan

Western Carolina University

Oxidative stress is a common occurrence in diseased and damaged cells. Hydrogen peroxide (H2O2) can be used to induce oxidative stress in lab-grown cells and may alter important processes, including pathways that recycle cellular materials. The purpose of this study was to determine how H2O2 affects cell recycling pathways in HEK293 cells and whether keratin or gelatin could help protect cells from oxidative stress by modulation of these pathways. HEK293 cells were exposed to hydrogen peroxide to induce oxidative stress. Cells were transfected with a green fluorescent protein (GFP)-tagged recycling pathway marker (250) so that changes within this pathway could be observed using an EVOS FL Auto fluorescence microscope. MTT and WST-1 assays were performed and measured using a plate reader to assess cell health. Keratin and gelatin were tested in same-day and 24-hour assays to examine how they affected the cells' response to oxidative stress. Hydrogen peroxide exposure generally reduced cell metabolic activity and increased aggregation—an indicator of cell recycling. Our data suggest that keratin may help reduce the effects of H2O2, but how it does this is still unclear. Future studies will investigate whether keratin directly lowers the amount of H2O2 present. Understanding these effects may help determine whether keratin can be used to protect cells from oxidative damage.

Identifying Molecular Targets of Restless Legs Syndrome in Animal Models

Simran Takhar

Mentored by: Stefan Clemens

East Carolina University

Restless legs syndrome (RLS) is a chronic neurological disorder characterized by an uncontrollable urge to move the legs, with symptoms that worsen at night and disrupt sleep. Dysfunction of the iron and dopamine (DA) systems is involved in RLS, but the underlying mechanisms remain unresolved. Hyperpolarization-activated cyclic nucleotide-gated channels (HCNs) regulate neuronal excitability and can be modulated by DA via the DA D1 receptor (D1R). Here, we assessed the protein expression of D1Rs and HCN1 and HCN2 in three established RLS models, the Meis1 knockout (Meis1KO), the iron deficiency (Fe-ID) model, and the DA D3 receptor knockout mouse (D3KO). Meis1 has been identified in genome-wide association studies of RLS patients, the Fe-ID model replicates the reduced iron homeostasis observed in RLS, and the D3KO model serves as a tool to understand the consequences of altered DA function. Using standard Western blotting techniques, we found that D1R was significantly increased in all three models, and that HCN1 and HCN2 protein expression was significantly increased in D3KO animals but not in the Meis1KO or the Fe-ID model. These preliminary data suggest a role of the D1R in RLS, but the mechanism through which it acts may be more diverse than anticipated. We are currently extending our studies to include analyses of DA-related proteins that may be involved in regulating the D1R. This work may provide insight into the molecular mechanisms underlying RLS and identify targets for future therapeutics.

The Cost of Control: How Deep Brain Stimulation Disrupts Identity and Consent

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Mentored by: David Cantrell

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Deep Brain Stimulation (DBS) has transformed the treatment of neurological disorders such as Parkinson's disease by restoring motor function, reducing symptoms, and giving patients greater independence. However, its ability to directly alter brain activity raises important ethical questions about autonomy, identity, authenticity, and informed consent. This paper argues that while DBS can restore physical autonomy, it can also disrupt a patient's sense of self through changes in personality, emotions, values, and behavior. These changes challenge the assumption that greater physical independence automatically leads to greater autonomy. When autonomy is defined primarily through physical function, medical success may be measured by symptom reduction alone, overlooking the possibility that patients can regain control of their bodies while feeling disconnected from their identities. To explore these issues, I examine clinical sources, patient narratives, and neuroethical scholarship. Clinical literature often emphasizes measurable outcomes such as improved mobility and reduced tremors, while patient experiences reveal emotional changes, shifts in values, relationships, and uncertainty about identity. Drawing on neuroethicists such as Felicitas Kraemer, Alistair Wardrope, Jonathan Pugh, Shaun Gallagher, and Eran Klein, I argue that autonomy depends not only on independence but also on authenticity and psychological continuity. Because DBS may alter a patient's values or sense of self, informed consent becomes increasingly complex. Ultimately, DBS demonstrates that autonomy, identity, and consent are deeply interconnected, revealing limitations in current medical ethics and the need for frameworks that account for identity-altering neurotechnologies.

Multilingual Students in Monolingual Classrooms: Observations from Service Learning in Belize

Madison Talton

Mentored by: Deana McQuitty

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Multilingual students are often educated in classrooms where the primary language of instruction differs from one or more languages they use in their daily lives. In these environments, language differences may be misinterpreted as language delays or communication disorders, emphasizing the need for culturally and linguistically responsive educational and speech-language practices. This ongoing project examines multilingualism within primary school classrooms in Belize and considers how educators and speech-language professionals can better distinguish language difference from language disorder. Initial observations were conducted during a service-learning experience in San Ignacio, Belize, where literacy activities were completed in primary school classrooms in which English served as the language of instruction and students used English, Creole, Spanish, and Mayan languages. Observations indicated the use of code-switching, peer support, and increased confidence with language exposure. The project is being extended through additional classroom observations and descriptive data collection examining classroom enrollment, languages spoken by students, the proportion of students using each language, and the language used for classroom instruction. These data will provide additional context for understanding the linguistic environments in which multilingual students learn. By examining the relationship between students' linguistic backgrounds and classroom language expectations, this project highlights the importance of considering a student's complete language experience when interpreting academic and communication performance and developing culturally responsive assessment and instructional practices.

Associations Between Tree Fecundity and Wildlife Distribution

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North Carolina School of Science and Mathematics

Climate change has altered the distribution, productivity, and reproductive output (fecundity) of trees, affecting both the quantity and timing of mast— the production of seeds crops like fruit and cones. Since mammals rely on mast as a food resource, climate-driven changes in seed availability may alter wildlife foraging behavior and distribution. This project integrates Duke Forest (DF) mast and camera trap datasets to investigate the relationship between tree fecundity and wildlife distribution, improving understanding of how consumers respond to fluctuations in a food source. DF mast datasets will be analyzed in RStudio to model annual mast production at seed trap locations. Camera trap data collected in 2019 and 2025 from representative areas of DF will be processed through the Wildlife Insights platform. Abundance and detection rates of white-tailed deer and eastern gray squirrels will be quantified and visualized in RStudio for comparison with fecundity. Wildlife Insights analyses showed that detections of both species peaked during masting seasons, reaching approximately 80 deer and 140 squirrels in October. Early spatial analyses also indicate that mast production alone may not fully explain detection patterns. This study will clarify the impact mast has on species distribution, allowing for a better understanding of resource limitation and prediction of wildlife distribution as the climate changes. Limitations include the study's focus on DF and incomplete temporal/spatial overlap among datasets, which are concentrated in the Blackwood and Hardwood regions. Future work should expand coverage across Duke Forest and examine the effects of mast on mammal behavior.

Quantifying Genetic Structure in Mecklenburg County Dragonflies

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Mentored by: Sandra Clinton

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Urban watersheds face unique challenges including erosion, declining water quality, and loss of biodiversity. These processes of stream degradation can be grouped together under the term "urban stream syndrome," which is a common phenomenon throughout Mecklenburg County and many urban centers globally. Habitat fragmentation also reduces the genetic diversity of many organisms including macroinvertebrates, which are an important component of stream food webs. Given this influence on the ecosystem, macroinvertebrates function as bioindicators for overall stream health. Dragonflies serve as a great example of valuable bioindicators; they spend the egg and nymph stages of their lifecycle in streams, are easily obtained as samples, and have relatively limited mobility, allowing them to become accustomed to the conditions in a particular stream. Understanding more about the genetic diversity within these populations provides new insights into the barriers between them and how restoration can be most effective.There is a need for more long-term spatial and temporal analyses of Odonata species in urban settings in the Southeastern region of the United States, particularly using at least two independent gene fragments. This study will focus on analyzing the genetic connectivity among Boyeria vinosa or Progomphus obscurus dragonfly species in multiple sampling locations from two watersheds in Mecklenburg County from three points in time (~2000, 2010, 2024) using the 12s and 16s genes and analyzing their nucleotide sequence alignment. The results of these data will act as a model for aquatic insect dispersal in Southeastern urban ecosystems.

Computational and Experimental Validation of a Dermal Mimicking Gelatin Phantom for Enhanced Thermal Imaging

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Modern medical imaging techniques rely on rigorous validation to ensure accurate clinical representations of the human body. However, validating new modalities on live tissue is difficult due to its inherent biological variability. To overcome this challenge, tissue-mimicking phantoms are widely utilized to provide a standardized, reproducible testing environment. In this work, we present a two-pronged approach to validate Enhanced Thermal Imaging (ETI). ETI is a novel, real-time imaging technique that uses LED illumination to gently heat blood vessels, creating a natural thermal contrast detectable by an infrared camera for vascular mapping. First, we developed a gelatin-based phantom engineered to mimic both the optical and thermal properties of dermal tissue. Second, we developed a parallel computational model using MCmatlab to simulate photon distribution and heat diffusion, ultimately producing a simulated ETI image. In this study, we evaluate the accuracy of our physical testing platform by directly comparing the experimentally measured thermal responses from the phantom against the simulated data from the computational model. Ultimately, establishing this validated phantom framework will guide future experimental design and accelerate the translation of ETI toward reliable clinical applications.

Exploring Intentionality in Technology Interactions through Anti-Converged Media Device Packaging Solutions

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The modern human spends more than 40% of the day on the internet (Kemp, 2022). The dawn of converged media devices (CMDs) like the iPhone have led to marked productivity benefits, but also transformed time spent outside of work. This research will contribute to the push-back against digital integration into leisure activities - which have caused feelings of comparison, isolationism and depression termed ‘digital burnout’ - by exploring the design possibilities of concepts that create a separation between functionalities in convenient and striking form-factors. 2 anti-CMD concepts collecting user-determined analog devices (e.g. Mp3, wrist watch) will be taken through a two-stage engineering design process, including 3D NURBS-surface and Solid modelling (Rhino3D, SolidWorks), low and high fidelity 3D print prototyping (PLA, SLA), and fabrication techniques (e.g. 4th-axis CNC, Lost-Resin Casting) that highlight sensory engagement through material finishes. Future testing will employ feedback from subjects over 2 week studies tracking the effects of interaction with the concepts during leisure activities. Positive outcomes may include lower screen time, higher concentration, increased rates of community and hobby engagement. Use of such devices could encourage more intentional interaction with technology rather than media consumption, allowing for conscious choices in how time is spent in leisure. A design strategy involving call backs to historically-bold design languages may help replicate the emotions that users felt in context in an increasingly digitally-fatigued populace. References Kemp, S. (2022, May 4). Digital 2022: Global Overview Report — DataReportal – Global Digital Insights. DataReportal – Global Digital Insights. https://datareportal.com/reports/digital-2022-global-overview-report

Investigating the Role of MUC1 in Cancer Cachexia

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Mentored by: Aneesha Dasgupta

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Cancer cachexia, a syndrome characterized by progressive skeletal muscle and fat wasting, significantly reduces patient survival and quality of life. The transmembrane glycoprotein MUC1 is frequently abnormally glycosylated and shed in pancreatic ductal adenocarcinoma (PDAC) cancer, yet its specific role as an overall driver of muscle degradation remains poorly understood. This research aims to evaluate the role of MUC1 in triggering cachectic symptoms and to identify the molecular mechanisms responsible for cancer-induced muscle atrophy. This project utilized PDAC cells expressing MUC1 (KCM) and MUC1 knockouts (KCKO) generated in Pinku Mukherjee's lab. Firstly, validating the experimental model, western blots were performed on cell lysates to confirm MUC1 expression levels in KCM and KCKO cells. Results confirmed a MUC1 signal in KCM cells and an absence of the protein in KCKO, establishing a clean genetic system. Next, conditioned media (CM) were collected from both cell lines and applied to differentiated C2C12 murine myotubes to simulate systemic exposure. The resulting morphological changes were quantified to measure myotube diameter across multiple replicates. Furthermore, we analyzed downstream targets of MUC1, and their role in muscle atrophy. We hypothesized differential atrophy programs in the C2C12 myotubes treated with KCM or KCKO CM. Our findings increase the understanding of the molecular signaling between tumors and skeletal muscle, potentially identifying a new therapeutic target for mitigating the effects of cachexia, with the end goal of improving the quality of life for patients suffering from cancer.

Engineering a Localized Eupatilin-Loaded Zn-EGCG-Chitosan Nanocomplex to Mitigate Effects of Acute Innate Graft Rejection in Crassostrea virginica (Eastern Oysters)

Lema Tohnya

Mentored by: Heather Mallory

North Carolina School of Science and Mathematics

Tissue grafting is a procedure in which a piece of tissue is implanted into an organism, often to repair or rebuild. This is common in humans and oysters. Humans undergo organ transplant, and oysters undergo tissue grafting for pearl cultivation. Both species experience rejection of tissue due to the immune system. Multiple factors influence graft acceptance; however, innate and adaptive immune responses are the most prominent. This ultimately leads to acute or chronic organ failure and post-graft death in oysters, ending pearl formation. This study tested if anti-inflammatory flavonoid, eupatilin, and a localized nanoparticle-based drug delivery system, Zn-EGCG-chitosan, could reduce the inflammatory effects of tissue grafting modeled in Crassostrea virginica through hemocyte (oyster immune cell) activity and secondary infection. The nanoparticle complex was characterized using UV-visible spectroscopy and drug EE of eupatilin. Hemocytes were measured using a hemocytometer for four different treatment groups: control (no graft or treatment), graft: no treatment, graft: nanocomplex, and graft: nanocomplex + eupatilin. Additionally, control groups and grafts (nanocomplex + eupatilin) were challenged with the pathogen E. coli to identify their ability to fight secondary infection. Effect was determined using mortality rate and hemocyte characterization. The results suggested that nanocomplex combined with eupatilin is the most effective at reducing post-graft immune response and allowing C. virginica to fight secondary infection. These findings present Zn-EGCG-chitosan + eupatilin nanocomplex as potential candidates for future studies towards remedying post-graft immune response in other oyster species, such as Pinctada fucata, and in further studies inform strategies for reducing graft rejection in humans.

Evaluation of Grains of Selim and Honey as Alternative Antimicrobials Against Patient-Derived UTI Bacterial Strains

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Winston-Salem State University

Urinary tract infections (UTIs) represent some of the most prevalent bacterial infections globally, with Escherichia coli serving as the primary causative pathogen. Due to the alarming rise of antibiotic resistance among uropathogens, researchers are increasingly exploring plant-based and natural antimicrobial agents as alternative or adjunctive therapies to conventional pharmaceuticals. One promising agent is Grains of Selim (Xylopia aethiopica), a West African botanical with a rich history in traditional medicine for treating bacterial illnesses, coughs, and skin infections. Laboratory studies have already confirmed its efficacy in inhibiting various disease-causing bacteria. Similarly, natural honey boasts an extensive scientific record of antibacterial activity and has demonstrated success in synergistic pairings with antibiotics to reverse resistance. However, current literature lacks studies evaluating the efficacy of Grains of Selim both independently and in combination with honey against clinical bacterial strains cultured directly from UTI patients rather than standard laboratory reference strains. To address this gap, this study investigates the antimicrobial activity of Grains of Selim and honey against clinical UTI pathogens, aiming to provide a foundation for the pharmaceutical development of natural products to combat drug-resistant urinary tract infections.

Satellite-Based Mapping of Hurricane Florence Flooding and Building Exposure Along the Cape Fear River in North Carolina

Nam Tran

Mentored by: Trung Tran

Guilford College

This study compares three approaches for mapping flooding associated with Hurricane Florence along the Cape Fear River: a water-index method, maximum likelihood classification, and a support vector machine (SVM) classifier. Landsat imagery acquired before and after the storm is processed to distinguish inundated areas from other land-cover types. Previous remote-sensing research has demonstrated the value of satellite imagery and classification techniques for mapping flood extent, providing context for comparing these methods in a major hurricane event. The resulting flood maps are evaluated against reference data to determine which method most accurately represents observed flooding. The best-performing method provides a foundation for future flood-prediction research. To assess potential impacts on the built environment, the selected flood map is overlaid with a building-footprint dataset to identify buildings that intersect mapped flood areas. The analysis examines the strengths and limitations of each Landsat-based method and demonstrates how satellite imagery and building data support flood-impact assessment in the Cape Fear River region.

Assessing and Optimizing Public Transit Accessibility in Charlotte through Optimal Transport Analysis

Bryan Tran

Mentored by: Xingjie Le

University of North Carolina at Charlotte

This study looks at the accessibility and efficiency of Charlotte's public transportation system, with a focus on how well bus stops connect to where commuters live. Using GIS and optimal transport (OT), we analyze the relationship between commuter populations, represented by generated points within Census Block Groups, and existing bus stops. The process involves filtering geographic data for Mecklenburg County, generating commuter points based on the Commuter data, and using optimal transport to measure the cost of getting commuters to nearby bus stops. We also limit commuter and bus stop pairs to those within a 0.5-mile walking distance to better represent realistic access to public transportation. By looking at the resulting transport flows, we can identify areas where commuters have limited access to bus stops and find potential locations for improvements, such as adding new bus stops or changing routes. The goal is to use these results to better understand and improve public transportation accessibility in Charlotte.

Antibiotic Extraction from Soil Bacteria: Comparing Chloroform and Ethyl Acetate

Ngoc Tran

Mentored by: Carolyn Hoffman

Wake Technical Community College

Antibiotic resistance is a growing global health threat, and new antimicrobial compounds are urgently needed. Through the Small World Initiative, students search soil bacteria for novel antibiotics. In a previous experiment, soil isolates SB15 (Pseudomonas aeruginosa) and SB18 (Serratia sp.) showed promising but unclear antibiotic activity when extracted with ethyl acetate. Because solvents of different polarity extract different compounds, this study asked whether chloroform, a less polar solvent, could extract the active compounds more effectively. Isolates were grown on agar plates at 35 degrees Celsius for 24 hours, and the agar was cut, frozen overnight, and extracted with deionized water and either chloroform or ethyl acetate. The organic layer was collected, dried, resuspended in solvent, and applied to filter disks to test against gram-positive, gram-negative, and fungal tester strains. SB15 extracts inhibited five gram-positive strains, including Staphylococcus aureus. Chloroform extracts produced zones of inhibition of 15 to 31 mm and were the only extracts active against S. aureus, while ethyl acetate extracts gave less consistent results. No activity was observed against gram-negative bacteria or yeasts, and results for two molds were inconclusive due to unusual growth. SB18 showed no meaningful activity. These results suggest that SB15 produces a likely nonpolar compound active against gram-positive bacteria and that chloroform is the more effective solvent for extracting it. This work shows that solvent choice can determine whether a promising antibiotic candidate is detected, and further studies are needed to identify and characterize the compound.

Magneto-Mechanical Actuation as an Alternative Approach to Treating Glioblastoma

Ramiro Trejo

Mentored by: Juan Beltran-Huarac

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Glioblastoma (GBM) is the most aggressive form of brain cancer and exhibits invasive nature and extreme resistance to conventional treatments. In the last year, over 300,000 new cases of brain cancer were reported worldwide, yet existing treatments, including ionizing radiation therapy and chemotherapy, offer limited success. These costly methods not only fail to target and minimize tumor cells but also induce severe side effects, such as cognitive decline and damage to healthy tissue. This reinforces the need for alternative, target-specific strategies and has driven research into nanotechnology-based approaches, which have the potential to enhance drug efficacy while minimizing toxicity. This study examines a therapeutic approach that utilizes magneto-mechanical actuation (MMA) to induce cell death. By applying alternating magnetic fields to activate magnetic nanoparticles, magnetic energy is translated into mechanical forces that disrupt intracellular structures. The primary objective of this study is to optimize particle physicochemical responses and magnetic field parameters that govern this process. Specifically, we will optimize particle concentration (0-200 μg/mL) and exposure time (30-90 minutes). Colorimetric cytotoxicity assays (CCK-8) will be then used to assess cell viability, identifying which parameters maximize cytotoxicity. Furthermore, this study examines the molecular mechanisms underlying magneto-mechanically induced apoptosis, offering insight into how MMA operates at the cellular level. Through advancing understanding of this process, this study can aid in developing a more cost-effective, localized, and non-invasive alternative approach to current glioblastoma treatments. This work lays the foundation for potential clinical translations, ultimately improving patient experience and outcomes.

Creativity AND Law: Exploring design thinking in legal problem- solving and communication

Maddy Tripp

Mentored by: Cindy Gilson

University of North Carolina at Charlotte

How can creativity and design thinking transform the way legal professionals (Prosecutors,Defense, and Lawyers) solve problems and communicate complex information? Legal settings often require professionals to interpret complicated information, communicate with different audiences, and develop solutions to complex problems. Research on legal design and design thinking suggests that creativity, empathy, collaboration, and human-centered approaches can complement traditional legal work. This project matters because legal information can be difficult for people without legal knowledge or resources to understand, which can create barriers to understanding legal processes and systems. My inquiry question is: How can creativity and design thinking be used to improve legal problem-solving and communication? The process to answer this question, I will review existing research on creativity, legal design, and design thinking while also conducting observational research in Charlotte through publicly accessible court hearings and trials, where permitted. I will observe how prosecutors and defense attorneys use information, evidence, communication, and legal reasoning to address legal problems. I will also examine how legal information is communicated to the public. This project is still in progress, but I anticipate that examining legal design and design- thinking practices will show how creativity can support more human-centered problem-solving and communication in legal settings. The findings may identify approaches that could make legal processes and information more accessible to the public universally, not just in Charlotte. Lastly, the research findings and correlations made within the Charlotte community resonate with me specifically as a pre-law student who strives for community engagements and advocacy. This teaches me how to apply my knowledge and observations made to the real-world.

Evaluating the quality and abundance of coarse woody debris in a forested NC ecosystem after a prescribed fire

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Mentored by: Zakiya Leggett

North Carolina State University

Prescribed fire in a forested ecosystem heavily impacts the quality and abundance of coarse woody debris. Coarse Woody Debris (CWD) refers to dead standing or downed wood from trees. It is measured by decay class 1–5 and by the diameter of the debris. CWD decomposes due to fire, insects, weather, and certain microorganisms. CWD is extremely beneficial to a forested ecosystem, as it serves as a food source, a reservoir for nutrients, and a habitat for certain amphibians and insects. Higher amounts of CWD are linked to higher soil productivity, which is crucial for ecosystem health and growth. This study evaluated the diameter and decay level of course woody debris in 6 burns and 6 unburned plots in NC State University's Schenck Forest by walking in a diagonal across the plots and recording any course woody debris stepped on. The results revealed that burned forest plots exhibited a significantly higher abundance (55% in burned and 21% in unburned plots) of decaying wood and thicker pieces of debris (0.97 in burned and 0.79 in unburned plots) compared to unburned plots and that high-intensity prescribed fires accelerate natural tree shedding, which leads to larger and more rapid decomposing woody debris on the forest floor, playing a vital role in nutrient cycling.

Dark Triad traits in college

Savannah Trussell

Mentored by: Erin Moeser-Whittle

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The Dark Triad traits are Machiavellianism, psychopathy, and narcissism. They are understood to be undesirable antisocial behaviors due to their manipulative tendencies . This study aims to analyze whether Dark Triad traits are exhibited in college age (i.e. 18-22) Christian men more than any other college age or non-college age individuals. Past studies have agreed that individuals who practice a religion show a negative correlation with Dark Triad traits. However, this study factors the role of age and gender into the expression of these traits as well. The hypotheses state that college age Christian men will show a higher overall mean of Dark Triad traits as well as higher levels of the three separate traits. Using data collected from 2,333 college students , a factorial MANOVA found that the overall model was significant ($F(36) = 1.73$, $p < .05$). Although, College age Christian men did not show a significant difference in expression of Dark Triad traits compared to any of their similarly aged counterparts. Between age, gender, and religion, gender was the only significant predictor for overall Dark Triad expression (Female = 2.47, Male = 2.60). Within the gender variable, significant difference was only found in the expressions of Machiavellianism and Psychopathy, (Female = 2.62, Male = 2.75) and (Female = 2.01, Male = 2.17), respectively.

Precise RNA Editing of TDP-43 for Familial ALS

Keith Tu

Mentored by: Mitchell Yip

North Carolina School of Science and Mathematics

Amyotrophic Lateral Sclerosis (ALS) is a fatal neurodegenerative disease. Symptoms typically consist of paralysis, speech impairment, and respiratory failure. Because the exact cause of ALS is unknown, there is no effective cure. However, several genetic factors have been linked to a subset of familial cases, making gene therapy using RNA editing a potential candidate to restore healthy gene expression. We aim to demonstrate the efficacy of RNA editing for treating ALS by targeting a mutation in TDP-43, a gene that is commonly dysregulated in ALS. Our model mutation results in an alanine to threonine change at position 315 in the amino acid sequence. We will test editing efficiency of multiple RNA editing cassettes in a cell line that expresses this mutant TDP-43. Techniques such as reverse transcription, PCR, and sequencing will be used. By testing multiple RNA editors validated to show significant editing across different genes, we will identify top performing editors measured by the highest percentage of on-target editing. The architecture of our RNA editors has been validated by the field to show significant editing across different genes. This will help us design increasingly efficient editor sequences, and to predict the effectiveness against ALS. Future studies will use in vivo models to measure its effect on disease expression and quantities required for substantial effect. However, the experiment is not performed in a cell type representative of neurons, making possible discrepancies in expression that may affect editing efficiency. Despite these limitations, gene editing still holds high potential for targeting mutations driving ALS.

Modeling Moretti: Architectural Analysis of Mid-century Landmarks in Rome

Breonna Tuitt, Leo Rossi

Mentored by: Jeffrey Balmer

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How can architectural documentation act as a forensic tool in reconstructing and understanding lost architecture? Luigi Moretti was a 20th century Italian architect whose early work was inseparable from the dictatorship of Benito Mussolini. Moretti was commissioned to design several buildings for the Fascist government, including the Casa della Gioventù Italiana del Littorio (House of the Italian Youth), located in Rome's Trastevere district. These projects were completed just before the start of World War II: left largely undocumented, the buildings themselves were radically reorganized to fit the spatial demands of Postwar democratic Italy. Using collections of sketches, drawings, images, and other material, this research seeks to create a complete set of architectural representations to explain the spatial conditions of the original work. Documentation, including drawings and diagrams, will be derived from a 3D model of the building's initial state. This documentation will not only serve as the first complete representation of the original GIL building, but will also reveal its spatial qualities. Further, the use of architectural techniques to reconstruct the space will allow insight into the design process of these spaces.

NFE2L2 Pathway Mutations Co-Occur with RAS Mutations and display codon bias in human tumors

Akhil Tumuluri

Mentored by: Bernard Weissman

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The KEAP1-NRF2 signaling pathway protects cells from oxidative stress, and its dysregulation drives therapeutic resistance in many human cancers. NFE2L2 and KEAP1 mutations have been reported to co-occur with mutations in RAS oncogenes, but the biological basis of this interaction, and whether NFE2L2 mutations arise through similar processes across cancer types, remain unclear. We analyzed NFE2L2, KEAP1, and RAS mutation data from nearly 13,000 tumor samples across TCGA and multiple clinical sequencing cohorts to characterize 419 NFE2L2 mutations in head and neck (n=58), lung (n=243), and endometrial (n=118) cancers. Using Fisher exact, Kruskal-Wallis, Dunn, and Kolmogorov-Smirnov tests plus we found that KEAP1 mutations were significantly associated with RAS mutations, particularly in lung adenocarcinoma, while NFE2L2 mutations were not. By comparing reference mutational signatures, we also discovered that NFE2L2 mutation position differed significantly across cancer types (p=3.4 x 10-15): head and neck and lung squamous carcinomas were statistically indistinguishable from each other (p=0.116), each showing 72 to 79 percent of mutations concentrated at two consensus NFE2L2 binding motifs for KEAP1, closely matching an APOBEC mutational signature (cosine similarity greater than 0.95). Endometrial cancer differed significantly from both squamous cancers (p less than 0.0001) with a more dispersed pattern and no single dominant signature. We also found a novel NFE2L2 mutation in endometrial cancer, absent in the squamous tumors. These findings indicate that NFE2L2-activating mutations arise through distinct, quantifiable mutational processes depending on tumor type, informing cancer-specific therapeutic vulnerabilities linked to NRF2 pathway activation.

Computational Investigation of the Amyloidogenic Properties of Human Amylin within the C-terminal Domain through the Application of Multiple Proline Substitutions

Isabella Turner

Mentored by: Kyung-Hoon Lee

Chowan University

Amylin, also known as islet amyloid polypeptide, is an intrinsically disordered protein co-stored and co-secreted with insulin by pancreatic β-cells to promote satiety, delay gastric emptying, suppress glucagon release, and maintain glucose homeostasis. Human amylin forms islet amyloid in type 2 diabetes, and toxic species produced during amyloidosis lead to β-cell dysfunction and death. Because amyloid formation is strongly modulated by primary sequence, proline substitutions have been used to investigate amyloidogenicity and toxicity. Proline residues can disrupt β-sheet formation, potentially preventing the structural changes necessary for amyloid aggregation. We have investigated the amyloidogenicity of proline-mutated variants using single, double, and triple proline mutations within the C-terminal segment (residues 30–37) of human amylin. Using computational amyloid prediction tools, including ZipperDB, AGGRESCAN, Waltz, PASTA 2.0, and AmylPred2, we evaluated how targeted proline variants affect amylin aggregation. Our findings demonstrate that introducing multiple proline residues markedly decreases amyloidogenic propensity, yielding non-amyloidogenic peptide variants with potential therapeutic relevance.

Where to Next? Tourism in Kazakhstan

Alexandra Ugoji

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

Tourism is a multifaceted enterprise that utilizes governmental interests, international and domestic perceptions, economic and marketing tactics, citizen cooperation, and natural or manufactured attractions to survive. I examined tourism in Post-Soviet countries to understand how these countries' history and culture was and continues to be impacted by their Post-Soviet heritage, specifically Kazakhstan. I desired to comprehend how the Soviet Union's former presence in Kazakhstan shaped the way this country presents itself, remembers its own history, and interacts with its culture, specifically in regards to tourism. I investigated how history is taught to Kazakhstani children and the way this was reflected in tourist organizations' narratives. Kazakhstani history textbooks focus on events during and after Soviet colonization with minimal mention of the previously existing legacies. The textbooks' content carry heavy Soviet influence and rectifying this is an ongoing process. These textbooks, which are used to instill a sense of patriotism and national pride in children, portray war as a "great act of heroism" and omit civilian perspectives. Soviet presence is emphasized, diminished or erased at the tour guide's discretion. Memory is being distorted and histories erased to hide the true impact of the Soviet Union on Kazakhstan and rebrand the country in a favorable light to tourists. However, tourism inconsistently benefits the economy, often worsening income inequality, especially in developing Asian economies, such as Kazakhstan's. As my research continues, I wish to analyze tourism's social impact on Kazakhstan and to compare and contrast the Kazakhstani experience with that of other post-Soviet nations.

The Uzbek Kelin: Patriarchy Beyond Islam

Shadiya Urmanova

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

In my work, the socially paradoxical situation of the Uzbek kelin is observed through her relationship between patriarchy, national identity, and religion in post-Soviet Uzbekistan. By implementing historical analysis, literature, media portrayals, and personal testimony, I wish to emphasize the fact that the restrictive expectations placed upon kelins are primarily rooted in patriarchal traditions reinforced through post-independence re-traditionalization rather than Islam. Though religion, in this case Islam, is frequently referenced and exploited to legitimize women's subordination, the Quran's preachings on women's rights contrast with the typical cultural expectations and practices imposed upon these Uzbek brides. By distinguishing between religion and the ardently misogynistic political, economic, and social structures that promote gender inequality, I aim to challenge the Western misconception that attributes the oppression against Uzbek women solely to Islam and instead situates kelinhood within the broader context of patriarchal nation and society-building, thus clearing up the collective cloud of skepticism that many people wield.

Multi-Organ Immune Effects of Combined PD-1 and CTLA-4 Blockade in a Murine Melanoma Model

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Mentored by: Li V. Yang

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Immune checkpoint inhibitors (ICIs), including anti-PD-1 and anti-CTLA-4 therapies, enhance antitumor immunity but can also produce systemic immune effects in non-tumor tissues. Although ICI-associated myocarditis has been described, less is known about how combined checkpoint blockade affects the heart together with lymphoid organs responsible for T-cell development and immune regulation. This study examines treatment-associated changes in CD4+ T cells, CD8+ T cells, and F4/80+ macrophages in the heart, thymus, and spleen using a syngeneic B16F10 melanoma model. Wild-type C57BL/6 mice received combined anti-PD-1/anti-CTLA-4 therapy or isotype control, and tissues were analyzed using immunohistochemistry. In cardiac tissue, immune cells were counted per section and treatment effects were evaluated while accounting for experimental differences. ICI-treated mice demonstrated significantly higher cardiac CD4+ cell counts than controls (mean 36.85 vs. 11.75, $p = 0.0010$) and significantly higher CD8+ cell counts (38.59 vs. 10.41, $p = 0.0003$). F4/80+ cell counts were also higher following ICI treatment but did not reach statistical significance (28.66 vs. 22.40, $p = 0.1176$). Ongoing thymic analysis will compare CD4+, CD8+, and F4/80+ cell density between the cortex and medulla, while splenic analysis will evaluate treatment-associated regional immune cell distribution. We expect these lymphoid organs to demonstrate additional organ- and region-specific immune changes. Together, this multi-organ approach may clarify how combined checkpoint inhibition influences both cardiac inflammation and broader systemic immune regulation beyond the tumor microenvironment.

Modeling the Effect of Diamond Layer Thickness and Interface Resistance on Peak Temperature in Copper Heat Sinks

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Heat limits the performance of high-power electronics. CVD diamond conducts heat far better than copper, and prior work shows diamond spreaders reduce thermal resistance in high-power devices. Diamond is expensive, and the thermal resistance at the diamond-to-copper interface limits how much of that benefit is realized. This project asks how diamond layer thickness and interface resistance change the peak temperature at a localized heat source. I am building a Python model of a 2D copper block with a 3 mm wide heat source centered on the top face and a diamond layer between the source and the copper. The model will solve steady-state heat conduction using the finite difference method, with a fixed temperature at the bottom face and insulated sides. I will vary the diamond layer thickness and the interface resistance, and record the effect on peak source temperature. I will validate the solver against the analytical solution for 1D conduction through a layered slab. I expect a diamond layer to lower peak temperature compared to a copper-only block under the same heat load, and I will test how much interface resistance reduces that benefit. The results will show how much diamond a heat sink needs and how much interface quality matters, which supports cost-effective thermal design. Next, I will use the solver to search for diamond placements that remove the most heat per unit of diamond volume.

The Night Sublime

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We've conquered the night. We've commodified it. We push it at our will to our limits (depending on how long we can deprive ourselves of sleep) in favor of pushing our productivity further into a realm deemed unproductive, or by enabling our "unproductive" urges. Though night is omnipotent, our relationship with it has fundamentally shifted, especially relating to sleep. Ideas of a biphasic sleep (that is, a block of sleep divided into two regions separated by a period of wakefulness in between) existing before industrialization are popular, in part due to the work of Robert A. Ekirch. This period, one in the middle of the night in which people allegedly used to converse, spend time, and "lounge," particularly drew me to this project. It's a period of beauty, peace, and quiet that we've lost to time. My first question, then, was how our subjugation of night detracted from our experience of it. Kant described the "sublime" as "That … in comparison with which everything else is small." In this project, I argue that the night is another form of sublimity, one that immerses us in a whole, one larger than everything around us. My work then took me to questions of the Night Sublime: of the beauty in the astronomical, the urban, and in nature, and how our experiences of these sublimities shape us. Now, the Night Sublime leads me elsewhere: to how it's been distanced from us by social media, to the role of dreaming in the sublime, and more.

Digitizing the ETAP Field Data Card: A Shiny Application for Community Cleanup Events

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Trash pollution in waterways is a growing environmental challenge, yet data collected during routine cleanup events are often inconsistent, difficult to compare, and rarely used beyond the individual event. This project addresses this gap by developing a Shiny application based on the U.S. Environmental Protection Agency's Escaped Trash Assessment Protocol (ETAP), a standardized framework for documenting and categorizing escaped trash in terrestrial and aquatic environments. The application digitizes the ETAP Field Card, allowing volunteers to record trash items by material group and item type directly from a mobile device during cleanup events. GPS coordinates are associated with each entry, eliminating the need for paper tallies and subsequent manual data entry. The application also provides immediate summaries of cleanup results, including total items collected, material composition, and the proportion of intact versus degraded items. For stormwater managers and researchers, a longitudinal dashboard enables comparisons across cleanup sites and events over time, supporting the identification of trash hotspots and the evaluation of potential interventions. By combining standardized data collection with accessible digital tools, this project transforms individual cleanup events into a continuous and comparable dataset. The resulting system is designed to reduce barriers to standardized collection and provide municipalities, watershed organizations, researchers, and environmental agencies with more useful data for understanding and addressing trash pollution at its source.

Inducing PMOS-like symptoms in Drosophila melanogaster with polyethylene microplastics

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Polyendocrine Metabolic Ovarian Syndrome is a prevalent endocrine disorder affecting 8-13% of women of reproductive age globally. The etiology of PMOS ranges significantly yet studies suggest PMOS is driven by genetics, epigenetics, and lifestyle. In PMOS patients testosterone is a notable hormone which often plays a role in the disorder's pathology (most patients experience hyperandrogenism). This study explores the possibility of further developing Drosophila as a model organism in the study of PMOS. Drosophila utilize ecdysone, a hormone generally considered to be orthogonal to testosterone in humans, as a growth hormone crucial for development. By offsetting ecdysone production, PMOS-like reproductive arrest (such as disrupted follicle development) can occur. Since common modes of induction in Drosophila utilize a high sugar diet to increase insulin production and offset ecdysone, the induction process in Drosophila is a major point of concern considering it promotes high BMI (body mass index) to produce symptoms. As known endocrine disrupters, this study evaluates the reproductive, genetic, and bodily effects of polyethylene microplastic consumption that may suggest it to be a more pathologically representative mode of PMOS induction. To evaluate these effects, RNA was extracted from female flies for RT-qPCR analysis. Spook primers were utilized to quantify ecdysone production and RpL32 was utilized as a housekeeping gene. Fertility and weight were analyzed. Ovaries were physically extracted to observe follicular development. Preliminary results suggest that polyethylene microplastics may have an effect on Drosophila melanogaster's ecdysone production, weight, and fertility which denote PMOS-like symptoms.

Toward Automated Monitoring of Augmented Reality Guidance and User Safety Using Large Multimodal Models

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Augmented reality (AR) devices, such as headsets and smart glasses, provide workers with step-by-step guidance through real-world tasks like assembly and repair. When that guidance is misaligned, it can slow users down, cause errors, and distract them from hazards. Current automated methods fail to detect these errors before they reach users. This project asks whether large multimodal models (LMMs), which interpret both images and text, can evaluate AR guidance quality in ways that align with human judgment. Prior studies show that design choices such as information complexity and device type strongly affect speed, accuracy, and safety. Recent systems also use language and vision models to generate AR guidance with systematic quality degradations, paired with expert annotations and user studies that measure task performance and eye gaze to confirm each degradation's impact. We collect representative AR guidance and safety videos across diverse environmental conditions and a range of commercial AR systems. We pair readily available applications with in-house applications designed to surface edge cases and anomalies that reflect challenging user scenarios. Using this data, we will develop evaluation methods that combine LMM reasoning with video, AR platform data, and perception models to detect misaligned, unclear, or unsafe guidance before it reaches workers. The resulting dataset and methods will give AR developers a scalable way to audit guidance for quality and safety, and lay the foundation for systems that autonomously adapt instructions to protect workers in hazardous settings.

A Comparative Analysis of Large Language Model Response Consistency Under Semantically Equivalent Prompt Variations

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Large language models (LLMs) are increasingly used to provide information, solve problems, and support decision-making, but previous research has shown that their outputs can vary depending on how prompts are phrased. This study investigates the question: How does semantic variation in prompt wording affect the consistency of responses generated by different large language models? To examine this, a controlled set of underlying questions will be developed across factual, scientific, mathematical, logical reasoning, and ethical domains. Each question will be rewritten into multiple semantically equivalent prompts that preserve the original meaning while varying in wording and structure. Multiple LLMs will receive every prompt variation, and their responses will be evaluated for factual accuracy, semantic similarity, consistency, and changes in conclusions or uncertainty. The study is expected to identify whether certain models or question types are more sensitive to prompt wording than others. These findings will contribute to understanding the reliability and reproducibility of LLM-generated responses and may provide insight into how prompt design influences AI behavior. By examining prompt sensitivity systematically rather than evaluating individual responses in isolation, this research aims to improve understanding of an important limitation of current LLM systems.

Association Between NeuroCom® Sensory Organization Test Performance and Functional Mobility Under Dual-Task and Gait-Constraint Conditions

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Introduction: NeuroCom® Sensory Organization Test (SOT) performance may not fully reflect functional mobility in healthy young adults. Purpose: To examine relationships between SOT composite scores and standard, dual-task, and gait-constraint mobility performance. Methods: Forty-three young adults (15 males, 28 females; age 19.8±1.3 y) completed three trials each of TUG-S, TUG-M, TUG-C, 10MWT-S, 10MWT-F, and 10MWT-L. TUG-M required carrying water, TUG-C required serial subtraction by 3s, and 10MWT-L required fast walking along a 2-inch taped pathway. Data Analysis: Trial means, dual-task costs (DTC), spill/error rates, and line-constraint cost were calculated. Paired effects used Cohen's d_z; Pearson correlations assessed SOT relationships ($p<.05$). Results: SOT was 81.2±5.9. TUG-S/M/C times were 8.05±1.11, 12.78±2.46, and 9.94±2.43 s; TUG-M/C DTCs were 59.8±27.7% and 24.0±25.5%. TUG-M and TUG-C showed very large and large effects versus TUG-S ($d_z=2.23$, 0.90; $p<.001$). Spill rate was 72.1%; cognitive error rate was 8.7%. 10MWT-S/F/L times were 4.86±0.62, 2.95±0.52, and 3.63±0.81 s; line-constraint cost was 23.3±16.4%. Fast walking substantially reduced completion time ($d_z=-2.78$), while the line constraint increased time ($d_z=1.32$; $p<.001$). SOT was inversely associated with line-constraint cost ($r=-.331$, $p=.030$), indicating higher SOT scores were associated with less slowing. Other SOT relationships were nonsignificant. Discussion and Conclusions: Manual, cognitive, and gait constraints substantially challenged mobility, while SOT showed limited correspondence with most functional outcomes. This highlights the value of assessing mobility under conditions that closely challenge everyday movement control. Practical Applications: Combining SOT with challenging functional mobility tasks may provide a more complete assessment of balance and mobility in healthy young adults.

Who Gets to Decide? Black Community Authority in Race-Based Clinical Algorithms

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Clinical algorithms increasingly shape decisions about who receives care and how care is delivered. Some have used race as an input, producing different results for Black patients. Between 2020 and 2024, several practices were revised, including the use of a race coefficient in equations for estimating kidney function. At the same time, healthcare has developed structures intended to give communities a voice in research and treatment, many created in response to the exploitation of Black patients. Yet it remains unclear whether these structures played a role in changing clinical algorithms.This paper examines who had the authority to identify and change race-based clinical algorithms and where Black communities fit into that process. Across multiple documented revisions, it asks who raised each concern, who could approve or block a change, and whether affected communities were informed, consulted, or involved in decision-making. Procedural justice theory and Arnstein's ladder of citizen participation provide the framework for evaluating that involvement.Across these cases, Black patients appear primarily as subjects of clinical algorithms rather than participants in deciding how those algorithms are designed. Identifying that an algorithm performs differently across racial groups is a technical problem. Deciding whether race should be included, what outcomes a model should prioritize, and whose interests should shape those decisions are questions of authority. Those decisions have largely remained with clinicians, researchers, institutions, and technology vendors.This paper asks why existing mechanisms for community participation in healthcare did not extend to clinical algorithms and what meaningful community authority would require.

Prompt-to-Product: Integrating Artificial Intelligence and Guided Inquiry into an Undergraduate Biodiesel Laboratory

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As generative artificial intelligence (AI) becomes increasingly accessible to students, chemistry educators face the challenge of incorporating these tools in ways that strengthen, rather than replace, scientific reasoning and hands-on learning. This study examines a "Prompt-to-Product" guided-inquiry laboratory that integrated AI into a multistep biodiesel investigation in General Chemistry II (N = 16). Students used AI within a structured inquiry framework to support planning and evaluate scientific information before producing biodiesel from waste cooking oil through transesterification. They subsequently evaluated their products using experimental measurements and thermochemical analysis, compared results with expected or literature values, and considered sources of experimental error. Student learning and perceptions were examined through pre-laboratory and post-laboratory work, rubric-based analysis of student responses, experimental results, and surveys. Initial survey results indicated high engagement (mean = 8.1/10) and generally positive perceptions of the AI-supported guided-inquiry experience. Expanded analysis examines patterns in student reasoning across the laboratory activities and follow-up survey responses collected approximately one year later, including students' perceptions of learning, AI use, and the value of the real-world laboratory experience. Together, this work investigates how AI can be incorporated responsibly into an authentic experimental setting while preserving student decision-making, critical evaluation of AI-generated information, and evidence-based scientific reasoning. The project provides a model for combining AI literacy with guided inquiry and hands-on undergraduate chemistry education.

Predicting User Departure from Hate Communities: A Multi-dimensional Analysis of Reply Features

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Online communities can be a breeding ground for hate and extremist ideologies which may lead to offline violence and radicalization. Understanding what makes users leave these groups is critical for developing effective interventions. While prior work suggests counterspeech can reduce hate speech, it remains unclear which specific features of replies encourage users to disengage. We analyzed the linguistic and emotional features of replies received by users who left versus those who stayed in hate communities. Using a logistic regression model, we predicted users' likelihood of staying or leaving based on their initial post, the reply they received, and their subreddit. We then analyzed replies using pre-trained NLP models across sentiment, emotions, moral foundations, toxicity, hazard language, and word frequencies. We examined both ground-truth data and a balanced subset of high-confidence leavers and stayers from each subreddit to control for community-level topics. Results revealed consistent patterns, with the high-confidence dataset showing sharper contrasts. We discovered that leavers' replies exhibited significantly higher negative sentiment, increased hazard language, and greater toxicity including insults and identity attacks. Emotionally, the top five associated with leaving are disapproval, caring, annoyance, curiosity, and anger, whereas stayers' replies emphasized admiration, approval, excitement, desire, and optimism. Regarding moral foundations, while both groups' replies lean toward moral vices, associated replies showed slightly more positive values-based language particularly in general morality, ingroup loyalty, and purity. Interestingly, the keyword "welcome" appeared distinctly more in stay-associated replies. These findings suggest that people are significantly more likely to leave when they receive negative replies.

Art Therapy Applications within Pediatric Medicine

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Medical concerns, despite thorough explanation, cannot be felt by a third person, and rely on the use of verbal communication to be expressed. Verbal communication lies at the heart of the medical diagnosis process, which is a necessary process in determining the need of diagnostic testing and cause of medical ailments. With verbal communication being based on learned behaviors, verbal communication is highly interpretative and, therefore, not always a reliable source of information. Alternatively, this literature review introduces art therapy, a nonverbal method of communication, that can be used to overcome these communication challenges. Art therapy forms include drawing, clay, collage, and painting, which can be applied in a variety of ways within pediatric medicine to provide therapeutic relief to children. Art therapy in pediatric medicine assists patients to relieve treatment trauma, reduce psychological stress, and introduce an overall improved quality of life within children, which are localized to after treatment within pediatric medicine. The use of art therapy applications in other fields' diagnostic practices suggests that art therapy applications can be expanded to have an universal approach within pediatric medicine. In this universal approach, different creative-art based techniques are applied in pre-diagnosis, mid-diagnosis, post-diagnosis, pre-treatment, post-treatment stages to assist children in expressing their internal feelings, emotions, and issues. To illustrate this innovative approach, this literature reviews discusses the practical applications of art therapy in pediatric medicine, and proposes extended applications of art therapy and creative-art based techniques throughout the diagnosis process.

Evaluating BL41 Cells as a Model for Epstein-Barr Virus Infection

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Epstein-Barr virus (EBV) infects approximately 95% of people worldwide and is linked to stomach cancer and several types of lymphoma. During infection, EBV turns on viral genes that produce proteins needed for the virus to function inside infected cells. Studying early viral gene expression can help researchers understand how EBV affects B cells and how specific viral proteins regulate infection. EBNA-LP is an early EBV protein that helps promote viral gene expression, and previous studies in primary B cells have shown that removing EBNA-LP changes the expression of other EBV proteins. However, primary B cells are difficult to grow and maintain consistently in culture. Cancer-derived B-cell lines grow more efficiently in laboratory conditions and may provide a useful alternative. This study evaluates whether EBV-negative BL41 Burkitt lymphoma cells can model EBV infection and viral gene expression. BL41 cells were infected with recombinant wild-type EBV or EBNA-LP knockout EBV, which cannot produce EBNA-LP; both viruses contained a GFP reporter gene. Infection will be confirmed by identifying GFP-positive cells using flow cytometry. Additionally, Western blots will be performed to quantify viral protein expression in cells infected with wild-type EBV and EBNA-LP knockout EBV. We expect sufficiently infected cells to show detectable EBV protein expression, with higher levels of EBNA2 and LMP1 in wild-type EBV-infected cells than in EBNA-LP knockout EBV-infected cells. Reproducing the difference previously observed in primary B cells would indicate that BL41 cells can model the effect of EBNA-LP on EBV gene expression.

Observing morphological development in GGB maize (Zea mays L.) leaf whorls using SEM

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Mentored by: Margaret Young

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Maize (Zea mays L.) is a globally significant cereal crop that remains widely consumed for its diverse agricultural, industrial, and culinary applications. Many agriculturally significant maize lines exhibit genotype-dependent recalcitrance that limits their responsiveness to traditional tissue culture and transformation methods. Current tissue culture methods rely on harvesting immature embryos within a strict developmental timeframe, typically 10-12 days after pollination. In addition, the technical expertise required to isolate immature embryos for in vitro manipulation may limit accessibility for students, novice technicians, and emerging researchers. Morphogenic regulator (MR) systems represent a recent biotechnological tool developed to combat genotype-dependent limitations through the promotion of tissue regeneration and phytohormone responsiveness. MR systems have enabled the use of alternative explants that are more readily available and less labor-intensive relative to immature embryos. Moreover, co-expression of combined MRs can enable the formation of somatic embryos directly from maternal tissues, bypassing a prolonged callus phase. Here, we evaluated the effectiveness of the GGB system [GRF4-GIF1 and BABY BOOM (BBM)] using leaf whorl segments. Scanning electron microscopy (SEM) was performed over a two-week period to characterize growth and morphological development under this system. Early morphological changes of explants obtained from 7-day, light-grown seedlings were observed four days after placement on medium supplemented with 2,4-dichlorophenoxyacetic acid (2,4-D). Primary embryogenic structures arising from maternal leaf tissue exhibited discrete regional protuberances suggestive of repetitive somatic embryogenesis (RSE). Identifying developmental responses undetectable through macroscopic evaluation alone may guide the optimization of regeneration protocols and maize transformation systems.

Neurodivergent Nurses: Navigating the New Graduate Experience

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Mentored by: Lori Hubbard

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Neurodivergent individuals account for 15 to 20 percent of the population, with collegiate enrollment increasing by 900 percent over the past decade. Despite this growth, nursing programs and hospital orientation systems lack evidence-based strategies to support neurodivergent nurses, contributing to severe transition shock and job turnover near 41 percent. Grounded in Schlossberg's Transition Theory, creating neuroinclusive support pipelines is essential, yet empirical research on how these nurses navigate workplace norms remains sparse. Here, in a mixed-methods longitudinal study, we examined how senior nursing students and early-career registered nurses navigate intensive clinical coursework and adapt to hospital culture. Using an initial survey—which respondents could complete anonymously or opt into providing contact details for a follow-up interview—with adapted Casey-Fink instruments alongside semi-structured virtual interviews, we evaluated clinical confidence, behavioral masking, and workplace stress across four theoretical domains (Self, Situation, Support, and Strategy). Preliminary quantitative trends and emerging qualitative insights show that unaddressed sensory demands and behavioral masking significantly elevate transition stress, while highlighting unique strengths neurodivergent nurses bring to clinical care. Together, these results indicate that traditional onboarding creates a mismatch with neurodiverse processing styles, threatening workforce retention. As the next steps, we will conduct thematic coding of qualitative interview transcripts and expand this research into a multi-site study across partner universities and regional hospital systems. This work underscores the necessity of moving beyond one-size-fits-all training to establish neuroinclusive residency pipelines that mitigate burnout and safeguard patient care.

Determine how the U2AF1 Q157P mutation alters the U2AF1-SETD2 interaction and chromatin-associated H3K36me3

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Mutations in the RNA-splicing factor U2AF1 are frequently found in myelodysplastic syndrome, acute myeloid leukemia, and other cancers. Although mutations such as S34F and Q157P are known to alter U2AF1 RNA-binding specificity and splicing, their effects on protein interactions and chromatin-associated functions remain poorly understood. This project investigates how the U2AF1 Q157P mutation alters its interaction with SETD2 and chromatin-associated H3K36me3, a histone modification involved in transcription, RNA processing, and genome maintenance. Preliminary FLAG affinity purification and proteomic analysis comparing U2AF1WT, U2AF1S34F, and U2AF1Q157P suggests that Q157P selectively alters the U2AF1-SETD2 interaction. We hypothesize that Q157P weakens this interaction and disrupts the chromatin association of U2AF1 and SETD2, resulting in reduced H3K36me3. To test this hypothesis, co-immunoprecipitation followed by Western blotting will be used to validate interactions between SETD2 and U2AF1 variants. Subcellular fractionation of K562 cells will then be used to compare U2AF1 and SETD2 across cytoplasmic, nuclear, and chromatin-associated fractions and measure H3K36me3 levels. These studies are expected to clarify whether altered U2AF1-SETD2 interactions provide a mechanistic connection between the Q157P mutation, chromatin regulation, and genomic instability.

The "Americanization" of Bossa Nova: How the Girl from Ipanema Lost Her Way

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Antônio Carlos Jobim's "Garota de Ipanema" ("The Girl from Ipanema") is one of the most popular songs to come out of the bossa nova style. However, its transformation from an intimate music style from Brazil into a product of American culture involved significant changes in the definition of the style. This paper analyzes how Jobim navigated the changing cultural and commercial climate of the United States in the 1960s. Through comparative audio and score analysis across three influential recordings—The Composer of Desafinado, Plays (1963), Getz/Gilberto (1964), and Sinatra/Jobim (1967)—this study examines shifts in rhythm, harmonic structure, and lyrical arrangement. Comparison between versions demonstrates how collaborations with American jazz artists led Jobim to simplify intricate percussion patterns, replace bossa harmonies with more consonant jazz voicings, and introduce English lyrics tailored to US radio markets. Conversely, Jobim's solo instrumental recordings reflect a deliberate effort to preserve the original bossa nova style Jobim helped to create. Grounded in audio-visual analysis and ethnomusicology, this research explores how musical styles change as they cross cultural boundaries. This analysis gives musicologists a practical framework for analyzing how American music industries adapt non-American music for their consumer markets.

Bayesian integrative approach identifies hidden intermediates in DH270-induced structural transitions of HIV-1 Envelope

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HIV-1 Envelope glycoprotein (Env) undergoes a sequence of structural transitions, from a closed conformation to an open structure, initiating host-cell infection. The closed-to-open transition proceeds through both short-lived disordered and more stable open-occluded intermediates, exposing distinct antibody binding epitopes. Thus, designing effective HIV-1 vaccines requires a deeper understanding of how Env opening changes antibody engagement. Time-resolved, temperature-jump small angle x-ray scattering (TR, TJump SAXS) previously captured the highly effective antibody CH848 binding to Env, however, the large structural heterogeneity hinders interpretation. To enable high-confidence structural interpretation of TR, T-Jump SAXS signals, we developed a novel integrative approach combining Markov state models, homology modeling, and a Bayesian inference framework to fit theoretical structures to experimental data. We generated structural models for each known Env conformation in several different CH848-bound states, yielding 9,600 unique CH848-bound Env models. Comparison of theoretical SAXS profiles from these models with experimental data indicates open-occluded intermediate and partially bound closed Env states contribute substantially to CH848-induced Env motions and inclusion of these partially bound encounter complexes significantly improves model fits. While improvements to the fit remain needed, our integrative modeling and Bayesian inference approach successfully fits atomic-resolution structural ensembles to high-resolution temporal data. These newly characterized structural transitions provide a foundation for future structure-guided HIV-1 vaccine design.

Development of an Advanced Filtration System for Nutrient Restoration and Optimization of Clean-in-Place Processes in the Dairy Industry

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The dairy industry remains a cornerstone of the U.S. economy, yet milk processing faces persistent challenges, including membrane fouling and biofilm formation within filtration pores, and reduced nutritional value from protein denaturation and modification of extracellular vesicles (EVs) during pasteurization and ultra-high-temperature (UHT) treatment. This project addresses these challenges by engineering a concentric filtration system with integrated cleaning capability and tubular filters of graded pore size spanning microfiltration to ultrafiltration length scales. The graded geometry drives size-based separation, retaining potentially harmful bacteria in the retentate while passing EVs into the permeate for downstream reintroduction, restoring nutritional value lost to heat treatment. Our current focus is fouling and biofilm, the principal barrier to sustained membrane flux, and size-based separation. We established bacterial growth and culture protocols for Corynebacterium callunae, the model foulant for our tabletop filters, by constructing a serial dilution growth curve with a plated dilution range of 10^2–10^9, measured by optical density. The quantified culture will be applied to stainless steel disks modeling our filter units under controlled vibrations to identify the frequency that most effectively inhibits and removes biofilm among 0 Hz (control), 50 Hz, 200 Hz, 1 kHz, and 4 kHz. The optimal frequency will be transferred to the tabletop filter. We completed the bacterial culture and growth curve. C. callunae incubation takes 48 hours; spectrophotometer recordings show an optimal optical density of approximately 0.85. Future work will integrate acoustic vibrations into the filtration system, providing chemical-free, in-situ fouling mitigation and cleaning-in-place during operation.

Developing an additivity-based method for estimating configurational entropy changes in proteins

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Binding processes in biological and medicinal chemistry require understanding two key properties: the energetic change and the entropic change on binding. The energetic changes are well understood and easily calculated, whereas the entropic changes are not. Of particular interest is the change in configurational entropy. Configurational entropy is the entropy associated with the restriction of different structural confirmations in a molecule during binding processes. Calculating entropy from molecular dynamics simulations is both an expensive and time-consuming endeavor, primarily due to the curse of dimensionality. This study aims to deliver a simpler method for estimating configurational entropy from molecular dynamics simulations of single peptides containing repeated amino acid residues and averaging the contribution by residue. Probability distributions are created from the resulting simulation snapshots to calculate entropy changes. We seek to investigate whether the entropic changes during a-helix formation can be approximated by additive contributions from individual residues, with the goal of creating a way for researchers to estimate entropy changes additively in larger proteins, to increase computational efficiency. We present initial results for the molecular dynamics simulations of 20-unit GLY, ALA, and VAL peptides.

Fruiting Fungal Diversity Comparison Pre and Post Severe Disturbance–Hurricane Helene and Soil DNA Metabarcoding

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As temperatures rise, hurricane activity becomes more frequent and intense–specifically in the Atlantic oceanic basin. With the recent impact of Hurricane Helene, we are able to quantify the effect these intensifying hurricanes have on our ecosystems, including fungi. Fungal fruiting bodies are only a miniscule fraction of the fungal diversity that exists within the soil and understanding the vast mycorrhizal network that interconnects flora can deepen our understanding of interspecies reactions to significant disturbances. By partnering with the Asheville Botanical Gardens and the Asheville Mushroom Club we can combine multi-faceted research and specimen collection to satisfy multiple endeavors. Metabarcoding has advanced classification efforts, sorting multiple specimens for DNA analysis from one soil sample. Using Oxford Nanopore Technology, bulk soil genomic sequencing can be done efficiently with single samples. This allows for affordable sampling and a clearer view of resulting trends in data of fruiting fungal response above ground after severe disturbance and a catalogue of below ground mycorrhizal diversity. It is expected that a change in fruiting fungal diversity will be found after the disturbance caused by Hurricane Helene. Cataloguing current soil mycorrhizal diversity will lay the foundation for future research for many topics, including, but not limited to, how atmospheric changes and disturbance events can affect soil mycorrhizal diversity.

Developing User-Focused Data Tools for the Next-Generation Skynet Robotic Telescope Network

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The Skynet Robotic Telescope Network is undergoing a ground-up rebuild into the next-generation Skynet Global Observatory. The new network will feature over 100 optical telescopes and over 10 radio telescopes worldwide, vastly expanding the current network's capabilities while maintaining the network's purpose as a tool for both professional astronomers and students. In my project, "Developing User-Focused Data Tools for the Next-Generation Skynet Robotic Telescope Network," Skynet's Astromancer data tool suite will be updated and integrated into the new network. Through the redesign and testing of existing tools, the time-series photometry and cluster modeling tools will have their interfaces and functionality updated to improve usability and reduce the technical barrier to entry. Astromancer's frontend will also be migrated from Angular to React, along with the implementation of a new data storage system. User accounts are being explored as part of this system, allowing users to save, revisit, and manage previous analysis work. The project is also exploring combining Skynet's Afterglow image-analysis workbench with Astromancer to create a unified Skynet Workbench. These improvements will complement Skynet's automated optical processing pipeline, which provides calibrated, analysis-ready data for further analysis. The resulting system is expected to create a more accessible and integrated data analysis environment, allowing students and professional astronomers to move efficiently from data collection and processing to scientific analysis.

Extraversion and Gender as Predictors for Sexist Attitudes.

Chanel Washington

Mentored by: Erin Moeser-Whittle

Fayetteville State University

Personality has been a defining factor in contributing to psychological research on sexism, sexual violence, and proposed methods to prevent these behaviors (Oliver et al., 2023; Russell & King, 2020). Previous literature has analyzed this relationship and discovered that certain dimensions of the Big Five personality model positively correlate with sexism and sexual harassment, specifically high extraversion and neuroticism, and low openness (Hardies, 2019; Vick, 2014). This research investigates whether big five personality dimensions predict certain gender role attitudes among individuals. Specifically, examining if extraversion and gender predict sexist attitudes. A multiple regression and t-test were computed on a sample of 2,316 college students to assess the role extraversion and extraversion with gender plays in predicting sexism and gender differences related to sexist attitudes. Regression results were significant and indicate that extraversion predicts sexism among individuals and sexism is more strongly predicted with the addition of gender as a variable. Results from the t-test suggest that males are slightly more likely to uphold sexist attitudes than females. These findings support personality as a predictor for sexism, establish extraversion and gender as indicators for sexist attitudes, and emphasize an area that should be further addressed. Considering this, it could also lead to improved assessments and screenings that prevent gender discrimination in social and workplace environments.

Efficacy of RNA thermometers in combating deadly pathogenic fungi

Rowen Watson

Mentored by: Rebecca Guth-Metzler

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Invasive fungal infections cause over 2.5 million deaths each year, creating a need for new antifungals as resistance to current drugs grows. A strategy under investigation for combating drug-resistant bacteria has not yet been explored for fungi, which is to target RNA thermometers (RNATs), RNA structures that control temperature-dependent gene expression. Computational screening and lab data from our research group identified a putative RNAT sequence in Pichia kudriavzevii, a World Health Organization priority fungal pathogen linked to invasive infections in immunocompromised patients and adult mortality as high as 67%. This project asks whether that Pichia kudriavzevii sequence functions as an RNAT and can therefore serve as a novel antifungal target. So far, the RNA sequence was amplified and inserted into a DNA molecule designed to both direct yeast to make the RNA and to, only if the RNA sequence is an RNAT, produce a fluorescent protein in response to temperature. Next, that DNA will be inserted into yeast, and any fluorescence signal from the fluorescent protein will be measured at different temperatures. If fluorescence changes with temperature, the sequence would be validated as an RNAT and as part of the fungus's temperature response and survival. This would support later work to create antifungals that target it and potentially reduce deaths from these infections.

Characterization of Microplastics Released from Consumer Plastic Food and Drink Contact Materials Using SEM and FTIR

Eva Weaver

Mentored by: Saman Majeed

University of North Carolina at Asheville

Microplastics are recognized as potential sources of human exposure through food and consumer products. Previous studies demonstrated enhanced microplastic release following mechanical or thermal stress; however, environmental stressors such as freeze-thaw cycles and humidity fluctuations remain largely unexplored despite their presence in everyday storage. Just as storage conditions can degrade consumer plastics, daily wear can impact personal care devices. Orthodontic aligners may represent an overlooked source of microplastic exposure due to prolonged oral contact and repeated mechanical stress during use. This study investigates microplastic release from plastic bottles containing water or sodas and Invisalign aligners under simulated stress and aging conditions. Bottles containing water or sodas underwent thermal and mechanical stress, freeze-thaw cycles, and humidity fluctuations. Additionally, aligners were washed and placed in saliva or water for 14 days at ambient temperature, with samples stirred 5 minutes daily to simulate mechanical wear. Particles were extracted using vacuum filtration and analyzed using scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDS) to examine morphology and elemental composition. Fourier transform infrared spectroscopy (FTIR) characterized polymer composition. Preliminary results indicate that environmental stressors accelerate plastic fragmentation and enhance microplastic release. Micro-cracking, surface delamination, and other morphological changes varied by material type and stress condition. SEM-EDS and FTIR provide complementary characterization of recovered particles and help distinguish polymer-derived microplastics from environmental artifacts. Invisalign samples demonstrated particle release following 14 days of treatment. These findings highlight the importance of incorporating realistic environmental and consumer-use conditions into microplastic exposure assessments and human safety risk evaluations.

Exploration into Mechanisms Behind Protein Translocation in Lymphocyte Apoptosis

Max Wei

Mentored by: Priyamvada Acharya

North Carolina School of Science and Mathematics

Lymphocytes, immune cells governing adaptive immunity, undergo multiple death checkpoints during their development. After immune responses, excess lymphocytes must die to prevent autoimmunity and to make way for new cells. Proteins such as Bax and Bak are essential for the initiation of apoptosis via death by instruction (Rathmell & Thompson, 2002). Signal transduction following the movement of Bax and Bak is well-studied. However, the molecular mechanisms governing the activation of such proteins are not fully known. We utilize the Protein Data Bank and the data visualization software ChimeraX to identify a potential activation site, the canonical hydrophobic groove, and a relevant structure, the BH3 death domain, in Bim, a Bax-activating protein. Then, we ran an AlphaFold simulation to identify whether this binding is likely, finding a confident, high-quality fit (ipTM=0.86 and pTM=0.83). Alongside previous knowledge that certain apoptotic stimuli, such as cellular atrophy or loss of metabolism, are followed by protein movement, this paper elucidates processes of protein translocation in apoptosis, advancing current understanding of lymphocyte apoptosis. The scope of this study is limited by current methods of protein visualization and lack of experimental evidence. We anticipate that this paper will provide a solid foundation for advancing the study of medicines that may prevent or slow the movement of apoptosis-inducing agents, potentially sustain the effects of activated immune systems, and drugs that initiate the culling of lymphocytes, which may improve prognosis in certain cancers and immune disorders.

The Effect of Ibuprofen on the Movement of C. elegans

Jacob White

Mentored by: Meredith Rowe

Gardner-Webb University

Caenorhabditis elegans are microscopic roundworms that are commonly used in research due to their survivability, reproducibility, and thoroughly recorded genome. Ibuprofen is a common household drug that is used, in humans, to cure inflammation and fevers through inhibition of COX-1 and COX-2 enzymes. Previous studies have investigated the impact of ibuprofen on the rate of reproduction and growth of C. elegans, though the impact on the movement capability of C. elegans under ibuprofen has not been fully developed. The purpose of this experiment was to determine the effect of water-soluble ibuprofen on the movement of C. elegans by studying their growth across culture plates and through chemotaxis assays. This was done using a camera system to track growth across a plate once worms were seeded onto the plate and through a chemotaxis assay, which provided stimuli on a culture plate to induce movement. The ibuprofen is expected to increase the movement of the C. elegans when it is placed in their environment at a non-toxic level and is expected to increase the growth and reproduction rate of the organisms themselves. This research is important to investigate the impact of ibuprofen on a model multi-cellular organism, as assumptions can be drawn about its effects in larger organisms cells.

Cell Response to Biomaterial Coatings During Nutrient Deprivation

Jordan Wilcox

Mentored by: Heather Coan

Western Carolina University

Understanding the mechanisms behind cell stress can assist researchers in developing systems to mitigate damage and promote wound repair. Our research is focused on better understanding how human embryonic kidney cells (HEK293) respond to stress conditions such as nutrient deprivation and determining how this stress might be mitigated by commonly used biomaterial coatings. We compared cell adhesion on poly-L-lysine and gelatin-coated surfaces to determine which coating would better support cell attachment during starvation. An LC3-plasmid system was used to visualize autophagy, a process involved in cell repair and survival. WST1 assays were used to evaluate cell toxicity under starvation conditions with and without the biomaterial coatings. Results showed that poly-L-lysine coatings provided substantially better HEK293 cell attachment and stability than gelatin coatings. Starvation media containing approximately 75% saline maintained sufficient cell survival and proliferation for autophagy observation while still inducing cellular stress. A slight increase in cell proliferation was also observed in starvation conditions supplemented with .01% gelatin. These findings help establish improved conditions for studying autophagy and cellular stress responses in HEK293 cells. Future studies will focus on developing our understanding of how coatings impact the autophagy process.

Investigating the Mycorrhizal Communities of American, Chinese, and F1 Hybrid Chestnut Seedlings with Oxford Nanopore Technology.

Mick Williams

Mentored by: Jonathan Horton

University of North Carolina at Asheville

The American chestnut (Castanea dentata) was once a dominant species in eastern North American forests, until the introduction of chestnut blight led to its functional extinction. Efforts to reintroduce the species include breeding with the blight-resistant Chinese chestnut (Castanea mollissima), such as the 94% American backcross hybrid developed by The American Chestnut Foundation (TACF). Ectomycorrhizal (ECM) fungal relationships are vital for seedling establishment. Therefore, successful reintroduction relies on understanding these relationships in each species. At TACF's Meadowview Research farm in Virginia, the three chestnut types were planted in pure stands of the three chestnut types and under non-ECM silver maple as a control. Three months later, five seedlings were harvested per stand x seed combination (60 total). Roots were separated, rinsed, and roughly 20 cm of fine root length was taken from the top, middle and bottom of the root system. About 100 root tips per seedling were randomly visually assessed for mycorrhizal colonization. Colonization rates were significantly higher in the American and Chinese, intermediate in the maple, and lowest in the hybrid stand, while seed-type had no effect. There was no interaction between seed-type and stand. 15 to 25 ECM root tips were collected for DNA barcoding with UNCA's Oxford Nanopore Technology(R) MinION Sequencer. The American stand showed the greatest species diversity and richness, followed by the Chinese, Hybrid and Maple stands. There was substantial overlap in species present in each stand. This provides critical preliminary data on ECM interactions, potentially informing future reintroduction strategies for blight-resistant hybrids.

Reducing Organometallic Waste in PTQ-10 Synthesis Through Direct Arylation Polymerization

Reagan Williams

Mentored by: Jeromy Rech

University of North Carolina at Asheville

Solar energy is an ideal renewable energy solution; however, the combination of high cost and bulky design has limited the implementation of traditional silicon solar panels. Emerging technologies, such as Organic Photovoltaics (OPV), have been developed and possess many unique features which avoid the aforementioned drawbacks. OPVs harvest sunlight through uniquely designed conjugated polymers, and over the past 25 years, have seen a huge growth in efficiency - from less than 1% to now surpassing 20%. These gains have been pioneered by new polymer design and synthesis, but the cost and environmental hazards of this chemistry has generally not been considered. Many common high-efficiency polymers rely on a Stille polycondensation reaction; a technique that not only uses very expensive organotin compounds, but also generates a significant amount of toxic byproducts. For example, the polymer PTQ-10, produces 340 g of toxic tin byproduct waste for every 1 kg of polymer produced. This work aims to explore a new polymerization methodology for PTQ-10 based on Direct Arylation Polymerization (DArP), a C-C coupling method similar to Stille that does not use organotin compounds. DArP utilizes C-H activation to create the same polymer without the use of tin by using a unique combination of palladium catalysts, specialized ligands, and starting materials. Obtaining the same high molecular weight polymer is challenging, and we have designed a series of new synthetic routes to produce monomers which can undergo DArP. This work will summarize these different approaches for the synthesis of PTQ-10 without organometallic waste.

MMF Thematic Analysis

Mandy Williams

Mentored by: Sharon Watson

University of North Carolina at Charlotte

This sub-study examines the experiences of participants in Cohorts 12 and 13 of the Moms Moving Forward program;. The mission of this program is to provide a pathway to economic mobility and improved overall wellbeing for participants and their families. Using a qualitative research design, this study will analyze participant interview transcripts of the aforementioned cohorts through applied thematic analysis; with a particular focus on how moms described changes in their parenting style and relationships with their children post-program. This will be determined by coding for recurring themes. The research seeks to better understand how parenting styles and improvements in child/mother dynamics occur as well as how these components may contribute to short- and long-term changes in participants' lives.This rapid sub analysis is apart of a larger inquiry of providing insights into areas that include but aren't limited to: employment, mental health, parenting, and resilience, etc for all cohort participants Particular attention will also be given to the role of coaching and the program's "sisterhood" model in building sustaining participant engagement and positive parenting styles. The findings of this study will be translated into insight into which program components participants perceive as most meaningful, where additional support may be needed, and how Moms Moving Forward can continue strengthening its approach to supporting mothers pursuing long-term economic mobility and stability.

Evaluating Eugenol as a HOG-1 Dependent Osmotic Stress Mimetic in Saccharomyces cerevisiae

Precious Khan Wondzi

Mentored by: Jing Ye

Salem College

Evaluating Eugenol as a HOG-1 Dependent Osmotic Stress Mimetic in Saccharomyces cerevisiaeEugenol, a major component of clove oil, is a naturally occurring bioactive compound with antimicrobial and cellular effects, but the mechanisms underlying its effects on cellular stress responses remain unclear. This study investigates whether eugenol produces cellular responses similar to osmotic stress and examines the potential involvement of the Hog1 stress-response pathway in Saccharomyces cerevisiae. Previous research has established Hog1 as an important regulator of the yeast response to high-salt and other osmotic stresses, providing a useful system for comparing the effects of eugenol with a well-characterized stress condition. Wild-type and hog1 mutant yeast cells were exposed to salt and eugenol under controlled conditions. Cellular responses were evaluated using OD600 growth curves, methylene blue staining to assess viability, and microscopic observation of cellular morphology. Preliminary observations indicate that both salt and eugenol affect growth and cellular behavior in wild-type and hog1 mutant cells, with both similarities and differences observed between the strains and treatments. These findings suggest that eugenol induces cellular stress but may not produce the same response as osmotic stress and may involve Hog1-dependent and independent responses. Further quantitative analysis will clarify these differences and help determine how eugenol influences cellular stress responses. This research contributes to understanding how a naturally occurring compound affects cellular physiology and may provide a foundation for investigating its effects on stress-signaling pathways.Authors; Precious Khan Wondzi, Jing Ye, Savitha Krishna

Assessing the Antimicrobial Activity of Bacillus subtilis Containing Probiotic Skincare Treatment

Kaitlyn Woods, Crystal Pham, Lacy Natale

Mentored by: Leila Reyes

Campbell University

The modern skincare industry centers itself around naturally derived ingredients, minimal skincare routines and prioritizing skin barrier health. A subset of products known as "probiotic skincare" claims to introduce beneficial living microorganisms to support the skin's overall microbiome. We surveyed 10 different commercially available products advertised as containing probiotics and found that most of them contain prebiotics, products derived from microorganisms but not living cells. We identified a product that claimed to contain live microorganisms, specifically Bacillus subtilis. The purpose of this research was to assess the antimicrobial properties of these probiotic skincare products against two bacteria that can be found on the surface of the skin: Staphylococcus epidermidis and Staphylococcus aureus. The product was diluted using a 1:10 serial dilution and cultured in LB broth. A spread-patch antimicrobial production assay was performed to evaluate the effects of the product-derived B. subtilis against the skin-associated bacteria of interest. A laboratory-supplied culture of B. subtilis was used as a control. After 48 hours of growth in an incubator at 32°C, zones of inhibition were observed around the higher-concentrated dilutions of product-derived B. subtilis against both S. epidermidis and S. aureus. Comparatively, the laboratory-supplied B. subtilis also indicated these results. These findings suggest that the product may have antimicrobial properties against some common skin-associated bacteria. However, further testing with additional trials would be required to determine the reproducibility of these results.

Phishing Abstract

Michael Woods

Mentored by: Longfei Wu

Fayetteville State University

Phishing emails remain a serious cybersecurity threat because many modern scams closely resemble legitimate messages. This project developed a Python-based phishing email detection prototype using a rule-based weighted scoring technique, which evaluates a suspicious email sample by assigning different weights to predefined categories of warning signs, including urgent language, suspicious links, spelling errors, unusual formatting, multiple brand names, and offers that appear too good to be true. The prototype was tested using 100 email samples (50 legitimate emails and 50 phishing emails) selected from the CEAS 2008 phishing dataset. The legitimate email samples received an average score of 21.14%, while the phishing email samples received an average score of 83.68%. The prototype correctly identified 43 out of the 50 legitimate email samples and 43 out of the 50 phishing emails, resulting in an overall classification accuracy of 86%. However, the overall performance was not as satisfactory as anticipated. In particular, several professionally written or casually worded phishing emails received scores similar to those of legitimate emails, and one legitimate email sample was incorrectly flagged as phishing. These results show that rule-based weighted scoring can serve as a useful supporting feature for phishing email detection, but it is not sufficiently robust to be used as a standalone detection method.

Antimicrobial Activity in HVAC Exposed Soils

Kaden Wrasman

Mentored by: Chasity Moore

South Piedmont Community College

As antibiotics become overused and misused, the use of pharmaceutical and agricultural antibiotic products can select for resistant bacteria, making effective future treatment challenging. Bacteria generally thrive in moisture-rich environments with adequate nutrients, suitable temperatures, and pH levels. In this study, soil samples were collected near HVAC units to explore whether the runoff moisture and conditions around these units may influence the bacteria present. Two soil samples were collected from HVAC-exposed areas on the SPCC campus and compared with a sample from an area with no known history of HVAC exposure. I hypothesized that soil samples collected near HVAC units would contain more antimicrobial-producing bacteria due to the unique environment around the units. Established Tiny Earth protocols were followed to isolate bacteria and test for antimicrobial properties. Bacterial isolates produced zones of inhibition against safe test organisms, suggesting potential antimicrobial activity. Future work will compare the isolates from each sampling area and investigate the genetics of promising isolates to better understand their potential for antimicrobial production.

Sex Differences in Visual Attention and Filter Use: The Moderating Role of Pubertal Development

Lillian Wu

Mentored by: Anne Maheux

University of North Carolina at Chapel Hill

Early adolescence involves increased social media use, including exposure to self-images. Frequent viewing and editing of these images may contribute to poorer body image and mental health. This study examined such behaviors in a novel task in which early adolescents edited a photo of themselves while eye-tracking glasses recorded their visual attention. Because females report greater body dissatisfaction and engagement with appearance-focused media, we expect females to use appearance-improving editing tools and look at sexually dimorphic body regions more frequently than males. Since early pubertal development may have contrasting body image effects for girls and boys, we expect pubertal development to moderate these sex differences. We hypothesize that more advanced development will be associated with greater time spent on sexually dimorphic body regions and with appearance-improving filters among females only. Early adolescents (55% female; Mage = 11.4) wore Tobii Glasses 3 while editing a full-body photo of themselves in Photoshop. Outcomes included time spent viewing predefined body regions (e.g., face, hips) and edit type (e.g., appearance-improving or appearance-silliness). Pubertal timing was measured using the Pubertal Development Scale. Regression analyses will examine associations between sex and visual attention to body regions, sex and edit type, and whether pubertal status moderates these associations. Coding will be completed by December 2026, with analyses completed by January 2027. Visual attention may be an early marker of later body dissatisfaction and clinical symptomatology. Examining puberty as a moderator may determine whether pubertal development functions as a risk or protective factor between sexes.

How Labor Practices in the Gaming and Animation Industries Contribute to Worker Burnout and Exploitation

Tyler Wu

Mentored by: Matt Thayer

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In the gaming and animation industries, studios strive to create many of the movies, TV shows, and games that people enjoy. These projects consist of hard working teams of artists, designers, and developers who put in a lot of effort to make their project both successful and enjoyable. However, many reports within these industries show that many of these workers are facing harsh working conditions that can lead to exhaustion and burnout.The research consists of finding reports or interviews from people working in either the gaming or animation industries. Additionally, ancillary reports regarding the working conditions of both industries were used. All of this culminates to understand why burnout can occur in either industries, as well as comparing work cultures to find potential solutions.Many of these issues contribute to burnout, which is not the same as simply feeling exhausted. Burnout can cause serious mental health issues, loss of passion for work, and occasionally even physical problems from repetitive tasks. Despite this, many companies do not provide proper support for their workers' well being.In general, while the gaming and animation industries produce popular and influential content, they often rely on exploitative systems that underpay and overwork their employees to the point of exhaustion. Addressing these issues is important not just for their well being, but also for the future of the industries that produce the content that we all enjoy.

A Sweet Kiss: Exploring the Bacterial Similarities of Couples Using Tongue Dorsum Saliva Samples

Breann Wusterbarth

Mentored by: Francisco Camacho

Catawba College

Intimate kissing has been proposed to be a source of bacterial exchange among romantic partners. It is estimated that a ten-second kiss can transfer approximately eighty million bacterial species (Kort R, 2026). Previous studies have found that frequent kissing is associated with greater oral microbiota, particularly enriched at the dorsum of the tongue. However, it is important to acknowledge that other factors such as diet, living environment, lifestyle behaviors, and the amount of physical contact could affect bacterial similarities or dissimilarities (Shaw et.al, 2017). This study aims to examine the null hypothesis; that there will be no correlation between the oral microbiomes of romantic partners. Multiple tongue swab from six couples have been collected with an ORAcollecttm Dx saliva collection device. DNA has been purified from these samples and tested for bacterial 16S rDNA. These samples will be processed on an Oxford Nanopore MinION for metagenomic sequencing. The representative oral bacterial communities will be analyzed for similarity. It is expected that the individual samples will have greater similarity to each other. Our question is how similar they will be to their partners oral microbiome. Understanding and acknowledging the dynamic patterns of bacterial composition amongst couples can provide insight into the mechanisms behind bacterial exchange - how oral bacteria moves from person to person.

Characterization of the surface morphology of resin dental composites

Breann Wusterbarth

Mentored by: Luis Fernandez-Torres

Catawba College

Resin-dental composites are an attractive alternative to traditional dental amalgams, as these composites are photocured, adhesive-bonded, and can be tailored to match tooth color. However, these composites are contraindicated for load bearing restorations, where amalgams are more effective. Furthermore, these composite materials often contain methacrylate monomers and bisphenol A, molecules known to be cytotoxic, genotoxic, and mutagenic. Previous studies suggest that the amount of bisphenol A (BPA) that may be released from dental restorations is considered minor, particularly when compared to typical background exposure to BPA in the environment and in food products. Thus, the surface morphology becomes crucial to assessing potential chemical and mechanical failures that could lead to exposure to harmful substances. The goals of this presentation are to characterize the surface morphology of a photocurable dental resin composite using scanning electron microscopy (SEM), and how different pH values and length of exposure could affect the composite's surface. To closely resemble the dental composite's expected use, a range of pH values and exposure periods consistent with typical food products were selected. It is hypothesized that prolonged exposure to low pH values can alter surface morphology. The results are discussed in terms of observed features (such as indentations), and their implications on composite durability, and safety. A further extension of this work will study potential effects on the composite's biocompatibility.

Synthesis of a Thiolated MOF/Graphene Oxide Hybrid for Enhanced Water Stability and Selective Removal of Heavy Metals

Fangjun Xu

Mentored by: Michael Bruno

North Carolina School of Science and Mathematics

Heavy-metal water contamination poses an increasingly problematic challenge for environmental and biological systems. Current solutions employ adsorption to separate heavy metals from water, but existing adsorbents are often limited by poor hydrothermal stability, insufficient selectivity, and limited adsorption functionality. It was hypothesized that hybridizing HKUST-1, a copper-based metal-organic framework, with Graphene Oxide (GO) would improve hydrothermal stability and that thiolation would increase heavy-metal selectivity and adsorption sites. HKUST-1@GO composites were synthesized solvothermally, then post-synthetically thiolated to form HKUST-1@GO-SH. FTIR spectra of the HKUST-1 composites matched reported literature, while SEM confirmed octahedral structures characteristic of HKUST-1. The progressive changes in morphology across each modification could indicate successful incorporation of thiol groups, suggesting increased surface functionality for heavy-metal adsorption. Further analysis after water exposure showed that the octahedral structures of HKUST-1 collapsed, while those of HKUST-1@GO and HKUST-1@GO-SH remained consistent, demonstrating improved hydrothermal stability after incorporation of GO that was not impacted by thiolation. Heavy-metal adsorption and selectivity testing of HKUST-1@GO-SH for Pb2+, Ca2+, and Cu2+ was initiated to determine whether thiolation achieved this goal, with results pending. More broadly, this research contributes to the development of more water-stable, efficient, and functionally selective MOF adsorbents, with HKUST-1@GO-SH showing potential for use in selective heavy-metal removal.

Development and Testing of Hybrid Self-Healing Fiber-Reinforced Polymer Composites

William Xu

Mentored by: Jake Lee

North Carolina School of Science and Mathematics

Fiber-reinforced polymer composites are widely used in aerospace, wind energy, and other structural applications because they combine high strength with low weight. However, these materials can develop internal damage that is difficult to detect and repair. Previous research has demonstrated that thermoplastic interlayers placed between composite layers can enable repeated thermal repair of delamination, but cracks can also form within the epoxy matrix itself, where interlayers cannot directly provide healing. This project investigates a hybrid self-healing composite that combines thermoplastic interlayers with a thermoplastic-modified epoxy matrix to address damage at multiple scales. A thermoplastic healing agent is incorporated directly into the epoxy matrix, where heating can allow the thermoplastic phase to soften, flow, and reconnect damaged regions. Preliminary work successfully fabricated thermoplastic-modified epoxy and demonstrated thermoplastic flow and rebonding during qualitative heating experiments. Current work focuses on incorporating the modified epoxy into fiber-reinforced composite laminates containing thermoplastic interlayers. Hybrid laminates are fabricated through fiber layup and resin infusion, cut into double-cantilever-beam specimens, and subjected to fracture testing followed by thermal healing and retesting. The expected result is measurable recovery of fracture resistance after heating, with the interlayers contributing to delamination repair and the modified matrix providing additional healing within the epoxy. This approach could expand self-healing capabilities across multiple damage modes and improve the durability and repairability of composite structures.

Effects of Gallic Acid and Epigallocatechin Gallate on Cell Viability in DRD2-Deficient SH-SY5Y Cells

Xztashya Xztashya Porter

Mentored by: Tomilowo Abijo

Fayetteville State University

Gallic acid (GA) and epigallocatechin gallate (EGCG) are naturally occurring polyphenolic compounds with reported neuroprotective properties, including the modulation of oxidative stress and inflammation, which are implicated in neurodegeneration and addiction-related pathology. This proof-of-concept study investigates the effects of GA and EGCG on cell viability in SH-SY5Y cells with reduced dopamine D2 receptor (DRD2) expression. The CRISPR-Cas9 gene-editing system was employed to generate a DRD2-deficient cellular model to investigate the potential effects of these plant-derived compounds under conditions of compromised dopaminergic signaling. Cell viability was assessed using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay following treatment with GA and EGCG at concentrations of 0, 12.5, 25.0, and 50.0 μM. Preliminary results demonstrated a significant increase in cell viability following treatment with GA at 50.0 μM and EGCG at 12.5 μM compared with the untreated control. These findings suggest that GA and EGCG may exert concentration-dependent effects on cellular viability in the context of reduced DRD2 expression. This study provides preliminary evidence supporting further investigation of plant-derived polyphenols as potential modulators of cellular responses associated with impaired dopaminergic signaling. Future studies incorporating additional molecular and functional assays and more physiologically relevant neural models will be necessary to elucidate the underlying mechanisms and determine the broader implications of these compounds for neuroprotection and dopamine-associated disorders.

Microwave-Assisted Synthesis of Indolizines from 1H-Pyrrolo[3,4-b]pyridine Scaffolds

Aisha Yakubu

Mentored by: Sezgin Kiren

Winston-Salem State University

Readily accessible fused pyrrole scaffolds were further functionalized through a two-step sequence. In the first step, Vilsmeier–Haack formylation afforded the corresponding pyrrole aldehydes in good yields. Subsequently, these intermediates underwent annulation with a bromoallyl reagent under microwave irradiation to furnish indolizine derivatives.

How Do We Activate Power When We're Sitting With the Provider

Saniya Young

Mentored by: Nicole Peterson

University of North Carolina at Charlotte

Women have been experiencing unfair treatment in healthcare for years, and most healthcare disparities affect Black women. This study examines the challenges Black women face in healthcare and explores ways to improve health outcomes for Black women in Mecklenburg County. We partnered with the Women's Healthy Equity Institute (WHEI) to create an evidence-based workbook for their self-advocacy workshop. WHEI is an organization that focuses on uplifting, encouraging, and opening opportunities for all women. The workbook aims to inform the public, promote health literacy, and encourage participation throughout the workshop. By studying Black women's experiences and feelings surrounding healthcare, we figured out what gaps we needed to fill. The workbook includes pages about important emergency hotlines, pathophysiology for common diseases among Black people, activities to keep participants engaged, and blank outlines to customize their workbook to their specific needs. By hosting a self-advocacy workshop, we can discover how people define self-advocacy, barriers to self-advocacy, methods that are most effective for spreading information, and how to create a lasting impact beyond informational sessions.

Physiological and Biomechanical Response to Progressive Swimming Intensity in a Controlled Pool Environment: Implications for Aquatic Safety

Madison Yousey

Mentored by: Andrew Harrison

University of North Carolina at Wilmington

Rip currents present a significant hazard to recreational swimmers, yet research quantifying the relationship between physiological effort and biomechanical performance remains limited. Previous research shows that increased swimming speed is associated with greater energetic demand and changes in stroke mechanics; however, physiological and biomechanical responses are often characterized independently rather than examined simultaneously across changes in swimming intensity. This study aims to determine how physiological effort and biomechanical performance differ between easy and fast swimming efforts, establishing a controlled baseline for future investigation of aquatic stressors. Participants complete repeated 25-yard swimming trials in a controlled pool environment at easy and fast intensities. Physiological workload is monitored via the ActiGraph LEAP, while bilateral EO SwimBETTER sensors measure stroke characteristics. Physiological and biomechanical outcomes are compared within participants between easy- and fast-intensity conditions. It is anticipated that fast-intensity efforts will produce greater physiological demand and corresponding changes in biomechanical performance. Specifically, heart rate and energy expenditure are expected to increase alongside changes in propulsive force and stroke frequency. Examining these variables together will help establish how increased physiological demand corresponds with changes in swimming performance as intensity increases. Establishing these responses under controlled conditions provides a foundation for subsequent investigation of how environmental stressors further influence physiological demand and swimming performance, with broader implications for aquatic safety.

Compensatory Spectacle: Masculinity in "The Good, the Bad and the Ugly," Within Its Italian Cultural Context

Bella Yuan

Mentored by: David Cantrell

North Carolina School of Science and Mathematics

This project examines the construction of masculinity in Sergio Leone's The Good, the Bad and the Ugly (1966), and asks how the film's visual style stages the relationship among its three central characters, and what this suggests about masculinity's construction within Italian, rather than Hollywood, cinematic traditions. Scholarship on the Spaghetti Western has established that the genre replaces the classical American Western's moral clarity with ambiguous heroes, while frequently marginalizing or omitting female characters; related work on Italian cinema of the same period suggests postwar Italian film frequently depicted masculinity within an unstable performance. Using analysis of Leone's visual style, I examine how intensity is managed among the film's three central men. This project suggests the film's hypermasculine surface functions as a form of compensatory spectacle, consistent with Italian cinema's broader postwar preoccupation with masculine inadequacy, and raises the possibility that this spectacle also allows homoerotic undertones to circulate alongside overt homosociality; an aspect of the film that remains comparatively underexamined. This project contributes to scholarship by situating a film central to American film canon within its national cinematic context, rather than an imported one.

The Influence of Snack Color on Snack Selection

Khiya Zahir

Mentored by: Kulwinder Kaur Walker

Elizabeth City State University

Color and visual presentation may influence consumers' perceptions and selection of snack foods. This preliminary study examined whether differences in snack presentation influenced participants' evaluations and snack choices. Thirty-five participants were divided into two experimental groups (Group 1 presented with healthy snacks, n = 16; Group 2 presented with unhealthy choices, n = 19). They evaluated 10 snack products for visual appeal and estimated price. Participants also identified snacks they would select for themselves, a friend, or a child, as well as their overall top choice. Independent-samples t-tests indicated no significant difference in overall appearance ratings between Group 1 (M = 32.75, SD = 7.89) and Group 2 (M = 30.76, SD = 6.16), p = .409. However, Group 2 reported significantly higher overall price estimates (M = 17.53, SD = 2.59) than Group 1 (M = 14.56, SD = 3.35), p = .006. Individual snack ratings also differed for selected products. Named snack-selection responses showed preferences for familiar snack products, including Doritos, spicy chips, Kit Kat, fruit snacks, applesauce, almonds, and popcorn chips. These preliminary findings suggest that visual presentation may influence perceived value and the appeal of particular snacks, although overall appearance evaluations were similar between groups.

Study of the Photometry of quasar 3C 273

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We studied the different aspects of brightness of quasar 3C 273 by getting data from different telescopes of said quasar and nearby stars, both my data taken throughout a few months and other researchers' data throughout the years, to have a decent range to be able to get clear peaks in the brightness. With that data, we can analyze the photometry and specifically filter B,V and R. Observing V, we can see interesting peaks in different aspects of it. On top of that, by looking at filter B and V, we can approximate the temperature of the outermost torus of heated gas and dust and sees how it varies, following Sekiguchi and Fukigita research on the matter, where following one of their tables and using B – V, we can find out an approximate value for the logarithm of temperature, and therefore, find the temperature. With this research, we expected to be able to study the temperature for interesting fluctuations and aspects of brightness of said quasar and study the periodogram to extract periodicity and constraint the size of the quasar engine.

The Role of Bone Marrow Endothelial Cell-Derived Extracellular Vesicles in Gastrointestinal Regeneration after Radiation Injury

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Radiation injury from accidental exposure, radiological terrorism, and radiation therapy can pose grave risks to public health by causing extensive tissue damage and death, including to the intestinal niche of the gastrointestinal tract. This is particularly dangerous as the intestinal epithelium facilitates nutrient absorption and regulates the immune system. Radiation sickness is often lethal, and there are currently no standardized treatments. We hypothesized that bone marrow endothelial cell-derived extracellular vesicles (EVs) could rescue damaged intestinal tissue following irradiation as previous studies have shown the restorative effect of EVs on hematopoietic recovery post-irradiation. To test this hypothesis, we generated EVs from primary bone marrow endothelial cells and quantified them by NanoSight. The effect of EVs was then studied in a murine small intestinal organoid model. Organoids were irradiated at several different doses. At 24 and 96 hours post-irradiation, EVs were added to the culture at a concentration of 10 x 10^9 EVs/well. Organoids were imaged using brightfield microscopy to visualize morphological changes over time. Organoid survival and budding index were also calculated. Additionally, caspase-3/7 live-cell staining identified apoptotic burden. We found that survival and budding index increased in organoids treated with EVs across all radiation doses. Moreover, qualitative observations showed decreased structural deterioration and apoptosis in EV-treated organoids. Our data demonstrate that EVs promote recovery of irradiated intestinal tissue by improving proliferation and reducing cell death. These findings support a regenerative role for bone marrow endothelial cell-derived EVs, highlighting their potential as a novel therapeutic strategy for mitigating radiation-induced gastrointestinal injury.

Design, Simulation, and Experimental Characterization of a Low Reynolds Number Micro Wind Turbine in Turbulent Wind Regimes

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Small-scale wind energy harvesting in urban and low-height environments is severely constrained by low Reynolds numbers (Re<100,000), low average wind speeds (5–6 m/s), and elevated flow turbulence. This study presents the design, aerodynamic simulation, and experimental validation of a custom micro wind turbine featuring a 0.35 m² swept area optimized for low-speed, highly chaotic wind conditions. Aerodynamic profiles were designed and modeled using QBlade's Lifting Line Free Vortex Wake (LLFVW) solver to balance low-speed starting torque against high-RPM power generation. Prototypes were fabricated using 3D-printed polyethylene terephthalate glycol (PETG), incorporating internal structural ribbing, high-perimeter wall counts, and precision bearing housings to eliminate structural flex and mechanical vibration. Performance testing was conducted in a conditioned airflow environment, utilizing an Arduino-based data acquisition system paired with an INA current/voltage sensor to track real-time electrical output (I, V, and P) across a 7.4V battery charging load. This paper evaluates the operational trade-offs between blade solidity, thickness, and rotational balance, quantifying their effects on cut-in wind speed, maximum power point behavior, and overall energy yield. The results provide a low-cost, reproducible methodology for bridging the gap between aerodynamic momentum theory and real-world micro-turbine performance in turbulent environments.

Neural Network Prediction of Cut Depth for Robotic Laser Surgery

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Robotic laser surgery enables precise, noncontact tissue removal, but autonomous operation requires knowledge about how laser-tissue interactions behave. Previous work has predicted individual laser craters and used mathematical models for multi-cut planning; however, a fast, data-driven model that learns the relationship between laser parameters and resulting tissue geometry could provide a better foundation for faster multi-cut laser prediction and planning. This project develops a neural network for predicting laser cut depth based on known laser parameters and optical sensing data (optical coherence tomography, OCT). Post-cut OCT data from 16 cuts on artificial tissue phantoms at varying laser powers were converted into 3D point clouds before identifying the crater, estimating the pre-cut surface, and reconstructing the laser path. These measurements were used to create a dataset containing laser power, each point's distance from the laser path, and cut depth, which was then used to train a multilayer perceptron. The best-performing network, with two hidden layers of 32 neurons each, achieved a test root-mean-square error (RMSE) of 0.0827 mm, a 0.7% reduction in error compared to a direct mathematical model with RMSE of 0.0833 mm, while also reducing mean prediction time by 28.5%, from 15.05 to 10.76 ms per cut. These results show that a small neural network is just as effective as a standard mathematical model in learning relationships between laser settings and cut geometry from OCT data, in less time. Future work will test generalization to new cuts, unseen powers, and biological tissue, and extend the model toward multi-cut planning.

Changes in Antibody Binding Capability of S. aureus Clinical Isolates Throughout Chronic Infections

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Staphylococcus aureus (SA) is a bacteria commonly found in both healthcare and community settings. SA infections are notoriously difficult-to-treat due to their ability to evade the immune system by binding to antibodies, reducing the immune response, resulting in chronic infections. Determining how antibody-binding capability changes throughout chronic infections provides insight into how SA adapts within the host to maintain infections. This research utilizes a novel assay based on centrifugation separating unbound antibody and antibodies bound by bacteria. The clinical isolates tested are incubated with a nonspecific, fluorescent IgG antibody. Three experimental groups were then assessed for their fluorescence - antibody alone, bacteria alone, and bacteria+antibody. Each group was split into two - one was centrifuged the other was not, and fluorescence of the supernatant was measured. When centrifuged, bacteria form a pellet, bringing any bound antibody with it, while unbound antibody remains suspended in the supernatant. Therefore, when bacteria and antibody are incubated together, if the bacteria bound the antibody, then the antibody will also be in the pellet, greatly lowering the fluorescence of the supernatant compared to the same group before centrifugation. Currently eight isolates of SA from a cystic fibrosis patient, collected over a three-year period, have been tested. The pattern of antibody-binding throughout chronic infection is initially high, followed by a decrease and plateau with another increase in antibody-binding by the end of the sampling from this patient. Antibody-binding remains present throughout chronic infection indicating that its likely aids in maintaining chronic infections.

How do professors teach undergraduate biostatistics? An exploratory study

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Background and purpose of study: Scholars have stated there is a lack of research regarding what is taught, and how it is taught, in biostatistics courses for undergraduate public health students. As such, the purpose of this study was to explore this topic. Methods: After receiving IRB approval (study # HS-25-239), a list of biostatistics instructors was created by contacting undergraduate program directors of accredited public health programs. A total of 65 instructors were provided by program directors and were invited via email to answer an anonymous online questionnaire consisting of 21 items (e.g., demographic information, class sizes, teaching methods, common student challenges). Basic descriptive statistics were used to analyze the data. Results: The study included 14 participants (response rate of 21%) who ranged in academic rank, teaching experience, geographic region, class size, and teaching delivery (i.e., in person, online, hybrid). The most common statistical software used included Excel and SPSS, and the most common statistical tests taught included: descriptive statistics, confidence intervals, chi-square, Pearson's correlation, independent and paired sample t-test, one-way ANOVA, and linear regression. Most professors assigned an individual and/or group project outside of exams. The most common challenges to teaching biostatistics included students': motivation, anxiety, and knowledge of foundational statistics. Conclusion: The findings from this study contribute to literature on how biostatistics is taught to undergraduate students, which can help inform professors based on the types of content and methods of teaching that are practiced in the field.