North Carolina Academy of Science

Since 1902

121ST ANNUAL MEETING OF THE NORTH CAROLINA ACADEMY OF SCIENCES

THEME:

"PROMOTING SUSTAINABILITY AND DIVERSITY IN STEM WORKFORCE"

MARCH • 28-29 • 2025

PRESENTATIONS • WORKSHOPS • EXHIBITIONS

NCAS PRESIDENT'S WELCOME

As the President of the North Carolina Academy of Sciences (NCAS) and on behalf of the NCAS Board Members, it is my privilege to welcome you to our 121st Annual Meeting. From our very first meeting in November of 1902 at Trinity College (now Duke University), the Annual Meeting has provided an opportunity for North Carolina scientists and science students to gather and discuss their ideas and highlight their research. That opportunity to share continues this weekend on the beautiful campus of Fayetteville State University.

As you know, the Academy's Mission is "to promote public appreciation of science, science education, scientific research and a meaningful role for science in public policy." The program developed by the faculty and administrators at Fayetteville states fulfills that mission with this weekend's focus on Enhancing Science and Sustainability through Innovation and Leadership. Our keynote speaker, Dr. Christine S. Grant of North Carolina State University, will addresses the challenge of science education in her talk entitled Resilience: "Research Empowered Science, Innovating Life-changing Improvements, Educating North Carolinians Everywhere".

I would like to thank Chancellor Darrell T. Allison, Provost Monica T. Leach, Dr. Afua Arhin Dean of the Lloyd College of Health, Science, and Technology and Dr. Erin White Associate Dean of the Lloyd College of Health, Science, and Technology for allowing us to share the facilities at Fayetteville State University for the Annual Meeting. Additionally, I would like to thank Dr. Daniel Autrey and Dr. Danielle Graham along with their team for organizing the exciting activities planned for this weekend. Please use the occasion to enjoy the poster and oral presentations as well as the planetarium shows.

Finally, the NCAS Board and I hope you take the time this weekend to build new connections and partnerships as well as provide mentorship to developing scientists.

THANK YOU!

MARK MCCALLUM,
2024–2025 NCAS PRESIDENT

Greetings from the Local Arrangements Committee for the 121st Annual Meeting of the North Carolina Academy of Science! This meeting is the Academy's largest event of the year, and we are excited to be hosting it here at Fayetteville State University.

Please take time to listen, learn, and enjoy the wonderful research performed by our CANCAS and NCAS members. The presentations at this meeting represent the culmination of many semesters of education and research. For many, this will be their first time presenting at a state-wide meeting. As you attend the keynote, seminars, and workshops, consider how making connections and communicating with others furthers scientific research. We have a special treat in store for you to visit our planetarium. The FSU planetarium has ten 4K projectors on a cozy 30-foot dome. This means there are more pixels per square inch on our dome than any other planetarium—in the world! We hope you take advantage of this opportunity to experience an immersive view of the universe.

The meeting's theme, Enhancing Science and Sustainability through Innovation and Leadership, pays tribute to the critical role that research and collaboration play in addressing global challenges. This meeting explores the intersection of scientific discovery, technological advancement, and environmental stewardship through presentations, a keynote, and panels. We hope you enjoy your time here and leave with new connections, fresh ideas, and a deeper understanding of how innovation enhances science.

Thank you for joining us for this inspiring event!

THE 2025 NCAS LOCAL ARRANGEMENTS COMMITTEE

DANIEL AUTREY, LOCAL ARRANGEMENTS CHAIR
DANIELLE GRAHAM, CHAIR OF EVENT PLANNING
WILLIETTA GIBSON, CHAIR OF REGISTRATION AND PROGRAM
SANGEETHA BALABHADRA, CHAIR OF ACCOMMODATIONS
JIAZHENG YUAN, CHAIR OF ORAL AND POSTER SESSION
BHOJ GAUTAM, CHAIR OF PUBLIC RELATIONS

COMMITTEE MEMBERS:

CHANDRA ADHIKARI, BIDISHA BOSE-BASU, AKANKSHA MANDAYAM NARASIMHAN, ALBERT CHAN, JAIRO CASTILLO-CHARA, ALI SIAMAKI , TIEMING GENG, RADOSLAV NICKOLOV, BO ZHANG, ALEXANDER UMANTSEV, SUBIR NAGDAS, MABEL AWORH, ARUN SAPKOTA AND SHUBO HAN

Schedule of Events

FRIDAY, MARCH 28, 2025

01:00 - 02:00 PM : FINANCE & STRATEGIC PLANNING COMMITTEE MEETING

(Lyons Science Annex, Room 128)

02:00 - 05:00 PM : BOARD OF DIRECTORS MEETING

(Lyons Science Annex, Room 128)

05:00 - 06:00 PM : REGISTRATION AND POSTER SETUP

(Chancellors Dining Hall)

06:00 - 06:15 PM : WELCOME REMARKS

- Dr. Daniel Autrey, NCAS Local Arrangements Committee Co-chair
- Dr. Afua Arhin, Dean, Lloyd College of Health, Science, and Technology
- Dr. Mark McCallum, Pfeiffer University, President of NCAS

(Rudolph Jones Student Center 238, 240, 242)

06:00 - 07:30 PM : POSTER SESSION AND RECEPTION WITH HEAVY HORS D'OEUVRES

(Rudolph Jones Student Center 238, 240, 242)

07:45 - 08:45 PM : FSU PLANETARIUM SHOW

(60-person capacity Lyons Science Building)

Schedule of Events

SATURDAY, MARCH 29, 2025

07:30 AM - 08:30 AM : REGISTRATION

(Rudolph Jones Student Center Lobby)

07:30 AM - 09:50 AM : PRACTICE ROOMS

(Lyons Science, Rooms LS 208, LS 213, LS 201, LS 209, LS 203)

08:30 AM - 05:00 PM : EXHIBITS FROM MEETING SPONSORS

(Lyons Science Annex Lobby)

08:00 AM - 08:30 AM : JUDGES AND SESSION CHAIR MEETINGS

(Lyons Science Annex, Room 128)

08:30 AM - 09:45 AM : ORAL PRESENTATIONS SESSION I

(Lyons Science Annex 120/121, 127, 129, 130)

10:00 AM - 11:15 AM : ORAL PRESENTATIONS SESSION II

(Lyons Science Annex 120/121, 127, 129, 130)

11:30 AM - 11:35 AM : WELCOME REMARKS

- Dr. Erin White, Associate Dean, Lloyd College of Health, Science, and Technology

(Rudolph Jones Student Center 238, 240, 242)

11:35 AM - 12:30 PM : KEYNOTE SPEAKER:

- Dr. Christine Grant, Professor of Chemical and Biomolecular Engineering, North Carolina State University

(Rudolph Jones Student Center 238, 240, 242)

Schedule of Events

SATURDAY, MARCH 29, 2025

12:45 PM - 01:45 PM : LUNCH

(Rudolph Jones Student Center 238, 240, 242)

01:45 PM - 02:45 PM : CONCURRENT SEMINARS

- Forensic Science Seminar

  (Lyons Science, Room 116)

- Artificial Intelligence Seminar

  (Lyons Science, Room 118)

- Faculty - Student Mentorship Workshop

  (Lyons Science Annex, Room 120/121)

02:00 PM - 04:00 PM : FSU PLANETARIUM SHOWS

(60-person capacity Lyons Science Building)

03:00 PM - 04:00 PM : BUSINESS MEETINGS

- NCAS

  (Lyons Science Annex, Room 120/121)

- CANCAS and Officers Award Preparation

  (Lyons Science Annex, Room 127)

04:00 PM - 05:00 PM : AWARDS CEREMONY

(Rudolph Jones Student Center 238, 240, 242)

05:00 PM - 05:30 PM : BOARD OF DIRECTORS MEETING

(Lyons Science Annex, Room 128)

KEYNOTE SPEAKER

DR. CHRISTINE S. GRANT

TITLE

RESILIENCE:

Research Empowered Science, Innovating Life-changing improvements, Educating North Carolinians Everywhere

KEYNOTE SPEAKER

Christine Grant is a Professor of Chemical and Biomolecular Engineering at NC State (1989- present) and served as inaugural Associate Dean of Faculty Advancement in the College of Engineering from 2008 to 2022, in this role she was responsible for faculty development, promotion and tenure (and post tenure review) in the college.
In the realm of STEM Policy, Grant has been a Visiting Senior Scholar at AAAS she's also served as an Expert and Program Director in the ENG directorate at the National Science Foundation (NSF).

The 2022 President of the American Institute of Chemical Engineers (AIChE); She served as the first African-American woman AIChE president. AIChE is a global organization of 60,000+ members in 110 countries. Grant has chemical Engineering (ChE) degrees from Brown (Sc.B.) and Georgia Institute of Technology (M.S. and Ph.D.). From 2020 to 2024, she served as the Program Director for Broadening Participation in Engineering (BPE) on an IPA assignment in the NSF ENG directorate.

Her writings include a co-edited book entitled, "Success Strategies from Women in STEM: A Portable Mentor" by Elsevier/ Academic Press and contributed chapters to: (i) "Growing Diverse STEM Communities: Methodologies, Impact and Evidence" (2019), (ii) Handbook of STEM Faculty Development (2023), and (iii) the American Chemical Society (ACS) Book "Overcoming Barriers for Women of Color in STEM Fields" (2020). Grant is a Fellow of AAAS, AIChE and American Society of Engineering Education (ASEE) and she is a Life Member of the: Society of Women Engineers (SWE), AIChE, National Society of Black Engineers (NSBE), American Association of University Women (AAUW), Advancing Indigenous People in STEM (AISES) and the National Council of Negro Women (NCNW).

She and her engineer (MIT/Duke) husband of 35 years, Kwame Yeboah, a Ghanaian, have provided educational and mentoring support to the Chemical Engineering Department at the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. They are the proud parents of a son, Kofie Yeboah (University of Maryland -College Park '17), an esports writer/engagement editor.

SEMINARS AND WORKSHOPS

MARCH 29TH, 2025 | 01:45 - 02:45 PM

LOCATION: LYONS SCIENCE ANNEX

1. FORENSIC SCIENCE: EDUCATION, CAPABILITIES, LIMITATIONS, RESEARCH, & LEADERSHIP COLLOQUIUM

By - Dr. Khalid Lodhi

This presentation is an overview of forensic science education. The presenter will discuss forensic science programs in North Carolina and neighboring states in relation to specialized accreditation. Also, it will give forensic science employment outlook and wages by state. Audience will learn about the crime laboratory challenges in recruiting and on the job training program on various forensic disciplines. Finally, the presenter will highlight forensic DNA capabilities, limitations and research.

2. ARTIFICIAL INTELLIGENCE SEMINAR

AI in Materials Science (Alexander Umantsev)

Artificial Intelligence is occupying more space and playing a greater role in our lives now. Examples are a popular software ChatGPT, which can help you automate tasks, analyze data, and create work reports, and use of AI for cryptocurrency mining. However, we should not think that AI is an invention of the recent past. In fact, great minds have been thinking about replacing human intelligence with a machine for a long time.

In this presentation we will briefly discuss some major steps in developing AI in the past and concentrate on applications of this technology in Materials Science now where it was known first as 'Big Data' and later as 'Machine Learning'. We will talk about how scientists found creative ways to discover new materials, optimize manufacturing processes, and enhance product performance. We will learn about emerging trends and real-world applications of AI to introduce Smart Materials and Manufacturing into our lives. I hope that this presentation will bring some valuable insight into the next generation of materials and manufacturing technologies which we are witnessing.

AI and Manufacturing (Joseph Kabbes)

This 30-minute presentation will discuss the use cases of AI in the Manufacturing space and give examples across various industries, with a focus on Aerospace. Topics discussed with include generative design, quality control, inventory and supply chain management, predictive maintenance, and assisted customer service. Also discussed will be the role of AI in implementing Industry 4.0 / 5.0 initiatives in manufacturing, and the need for Advanced Manufacturing technologies to deliver AI generated designs.

3. FACULTY - STUDENT MENTORSHIP WORKSHOP

Join us for an engaging one-hour faculty-student mentorship workshop designed to foster connections and enhance your academic journey. This informal setting encourages open dialogue, allowing students to seek guidance, share experiences, and gain valuable insights directly from faculty and staff members.

By - Dr. Mabel Aworh and Akanksha M.N

Whether you're seeking direction for your career path or looking for tips on securing internships, this workshop is the perfect platform to gain knowledge and ask questions in a supportive environment. Don't miss out on this chance to enhance your academic and professional journey.

ORAL PRESENTATIONS

ABSTRACTS

CELL BIOLOGY, MOLECULAR BIOLOGY, & PHYSIOLOGY

CBMBP-01

8:30-8:45 AM | LSA ROOM 127

Exploring the uptake and potential routes of microplastics in human endothelial cells: Implications of Environmental contaminants on cardiovascular disease

Khan, Ajmal*, Kyla Grant* Sarah Hudson*, Grant Koher*, Zhenquan Jia*
The University of North Carolina at Greensboro

Cardiovascular diseases (CVDs) are the leading cause of death worldwide, and atherosclerosis is a prevalent form of CVDs characterized by the thickening of blood vessels due to plaque accumulation. Microplastics (< 5000 µm) and nanoplastics (< 1 µm) (M-NPLs) are emerging environmental contaminants that have been detected in human blood, stool, placenta, lungs, sputum, saliva, hair, face skin, and hand skin. The negative impact of M-NPLs on cardiovascular health is a growing concern, and this study examined the uptake of M-NPLs at different concentrations, sizes, and exposure times in human microvascular endothelial cells (HMEC-1)., which play a critical role in the initiation and progression of atherosclerosis. HMEC-1 cells were treated with M-NPLs of different sizes (0.07, 4, and 10 µm), different concentrations (0, 0.1, 1, 10 µg/ml), and different times (0, 1, 3, 6, 12, and 24 h). After a 24-hour incubation, M-NPLs uptake was analyzed using a Bio-Tek® Synergy 2™ Microplate Reader and flow cytometry. The study showed that M-NPLs uptake in the size of 0.07 and 4 µm was significant compared with the control. M-NPLs uptake was also dose-dependent, with significantly increased uptake at a concentration of 10 µg/ml compared to 1 ug/ml. Furthermore, M-NPLs in the size of 0.07 µm had a time-dependent uptake pattern, with peak internalization occurring at 12 and 24 hours. The results of endothelial cells uptake of M-NPLs will enhance our ability to assess cardiovascular risk associated with human exposure to emerging environmental pollutants M-NPLs.

ORAL PRESENTATIONS

ABSTRACTS

CBMBP-02

8:45-09:00 AM | LSA ROOM 127

Orientation of Satb1 and Satb2 monomers within a dimer

Flores, Natalia*, Tshunza, Cristal*, and Schofield, Brett.
Wingate University

Eukaryotic cells regulate gene expression through chromatin organization, with architectural proteins such as Satb1 and Satb2 playing crucial roles in structuring DNA into functional domains. While Satb1 is known to form homodimers essential for T-cell development, the dimerization properties of Satb2 remain less understood. Given their structural similarity, Satb2 may form both homodimers and heterodimers with Satb1, but the orientation of monomers within these dimers is unknown. To investigate this, we employed a Bimolecular Fluorescence Complementation (BiFC) assay, in which the yellow fluorescent protein (mVenus) was split into non-fluorescent halves and fused to the N- or C-termini of Satb1 and Satb2. Fluorescence is restored when the mVenus fragments are positioned on the same side of a dimerized protein. HeLa cells were co-transfected with pairs of plasmids encoding these constructs, and fluorescence was observed when both mVenus fragments were fused to the N-termini of Satb1, suggesting that Satb1 homodimers adopt a parallel orientation. These findings provide insight into Satb protein dimerization, which is essential for understanding their role in chromatin organization and gene regulation.

CBMBP-03

09:00-09:15 AM | LSA ROOM 127

Exploring the substrate scope of the thiamine-dependent enzyme SucA: The effect of mutation at residues H260 and H460

Zulfiqar, Inayat*, Evan Reynolds
Campbell University

Enzymes represent attractive green catalysts for sustainable synthesis due to their ability to perform under mild, aqueous conditions and carry out highly selective transformations.

ORAL PRESENTATIONS

ABSTRACTS

However, their adoption in industry has been hampered by the limited scope of enzymatic reactions available. This research seeks to overcome this limitation by taking advantage of enzymes' promiscuity towards substrates not found in nature. In particular, we will explore the use of thiamine-dependent enzymes for the stereoselective formation of α-substituted ketones, which are important precursors to more complex, bioactive compounds. This will be accomplished by screening a panel of mutants of the enzyme SucA against substrates possessing multiple chiral centers to form stereochemically complex products. Specifically, we are exploring mutations at residues H260 and H460, which lie within the active site cavity. This research will expand the scope of reactions available to thiamine-dependent enzymes, making them more broadly useful for chemical synthesis.

CBMBP-04

09:15-09:30 AM | LSA ROOM 127

The effect of indigo dye biosynthetic intermediates on in vitro cotton (Gossypium hirsutum) fiber development

Throneburg, Ivy*, Michael R. Stiff
Lenoir-Rhyne University

Cotton fiber is a versatile material used throughout the world in many day-to-day items from coffee filters to textiles. Composed of 90% cellulose, cotton possesses the strength and absorbent properties needed for most of the clothing we wear. However, cotton textile production can harm our environment at many points in the production chain. For example, these products often use harmful dying conditions in textile mills. Chemical dyes can produce run-off disrupt ecosystems, decrease dissolved oxygen in the waterways, and damage root systems in plants. Many plants produce natural dyes like the blue dye indigo made by Indigo sativa. The indigo biosynthetic pathway is well studied. Cotton fiber begins as single-cell extensions from the surface of an ovule and can be grown in vitro in a well-established culture system ideal for testing novel methods of fiber cell growth. Can cotton fiber be made to produce its own blue dye to make cotton fiber dying more eco-friendly? We test the effect of indigo dye intermediates on the color, morphology, and callus formation of in vitro cotton fiber. Gossypium hirsutum cv. TexasMarker1 ovules (1 to 2 DPA) were grown in standard BT medium with 0.5 uM GA, 5 uM IAA and different concentrations of indole or naphthalene (0 to 2.0 mM).

ORAL PRESENTATIONS

ABSTRACTS

Ovules were cultured for 2 weeks (28°C in the dark). Indole treatments resulted in decreased fiber growth, ovule size, and ovule browning as concentration increased. Naphthalene resulted in more subtle ovule and fiber growth effects including continued growth of both tissues.

These results aim to contribute to the development of a novel, sustainable method for producing colored cotton fiber to reduce the environmental impact of textile dying while providing material for our vibrant textiles needs.

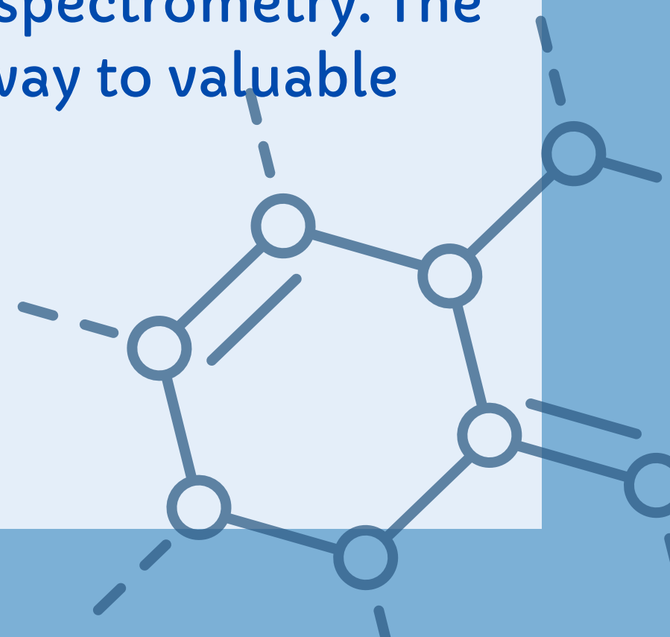
CBMBP-05

10:00-10:15 AM | LSA ROOM 127

Enzymatic cross-coupling of carbonyl compounds and alkyl halides: crossing into new territory with thiamine-dependent enzymes

VanWinkle, Rachel*, Evan Reynolds
Campbell University

Thiamine-dependent enzymes catalyze a variety of transformations in nature. We hypothesize that thiamine can also facilitate cross-coupling reactions between carbonyl compounds and alkyl halides, going beyond its natural scope. Preliminary results indicate that the thiamine-dependent enzyme, SucA, catalyzes the coupling of α-ketoglutarate with 1-(bromoethyl)benzene, an unprecedented reaction for these enzymes. To advance our study, we will continue reaction optimization and characterize the enzyme's selectivity. This will involve conducting reactions and monitoring product formation by liquid chromatography-mass spectrometry. The successful completion of this project will result in a novel pathway to valuable products with high yield and selectivity



ORAL PRESENTATIONS

ABSTRACTS

CBMBP-06

10:15-10:30 AM | LSA ROOM 127

Evaluating potential tetrachromacy in the MU community by visual examination of gas-discharge tubes

Haigler, Rebekah*
Methodist University

Vision, a mechanical function that varies for everyone, is classified into diverse types: monochromacy, dichromacy, trichromacy, and tetrachromacy. Monochromatic vision describes seeing only gray-scale images. Dichromacy is an umbrella term for colorblindness, whether it is red-green or blue-yellow colorblindness, while trichromacy describes average color vision where people can view all colors. Deviation from these main vision types causes a vision abnormality known as tetrachromacy. Tetrachromacy is a visual enhancement where people can see additional color nuances in the electromagnetic spectrum, meaning that they can distinguish between colors more proficiently than an average person. Tetrachromacy is a genetic condition carried on the X chromosome, in which a person has four cone cell-types instead of the normal three. The degree and effect of preliminary tetrachromacy was evaluated on Methodist University community students by having participants view the excitation of a gas-discharge tube containing either nitrogen gas, mercury gas, and helium gas. By measuring perception of the excitation spectrum for nitrogen, mercury, and helium gas, an approximate average of 8% in the MU community that was surveyed showcased enhanced color nuances potentially linked to tetrachromacy. The results and preliminary data reported here reflects how the MU community possess differential observations based on viewing excitation spectrum of these three gases. The potential for tetrachromacy within the MU community at large will be explored.

ORAL PRESENTATIONS

ABSTRACTS

CBMBP-07

10:30-10:45 AM | LSA ROOM 127

Māmaki extract inhibits M1 macrophage polarization in mouse bone marrow-derived macrophages

Yaru Si, Ajmal Khan, Noelle Klabunde, Christopher Pilgrim, Delicia Esther Cardenas Vasquez and Zhenquan Jia
Department of Biology, University of North Carolina at Greensboro

Atherosclerosis is considered an inflammation-mediated disease, which is a major cause of morbidity and mortality worldwide. Studies have shown that M1 macrophages produce cytokines that promote inflammation. Māmaki is a Hawaiian plant with various traditional medicinal values and cultural significance. In this study, we investigated the regulatory effect of māmaki extract on macrophage polarization toward M1. Mouse bone marrow-derived macrophages (BMDM) were treated with lipopolysaccharide (LPS, 100 ng/mL) in the presence or absence of different concentrations of māmaki extract for 24 h. RNA was isolated after treatment, and the gene expression levels of M1 macrophage markers IL-1β, IL-6, and TNF-α were measured by quantitative real-time polymerase chain reaction (qPCR). Our results showed that māmaki extract dose-dependently reduced LPS-induced IL-1β, IL-6, and TNF-α expression in BMDMs, indicating that Māmaki extract could effectively inhibit M1 macrophage polarization. This study suggests that Māmaki can reduce inflammatory responses by inhibiting macrophage M1 polarization.

ORAL PRESENTATIONS

ABSTRACTS

CBMBP-08

10:45-11:00 AM | LSA ROOM 127

Optimizing polymerase chain reaction (PCR) using gradient PCR

Andrade, Maricela*, Leah K. Frazier, Crystal C. Walline
University of North Carolina at Pembroke, University of North Carolina at Chapel Hill

Polymerase chain reaction (PCR) is a quick and practicable technique used to amplify copies of specific segments of DNA from a DNA sample. However, when conducting PCR, it is common to encounter complications such as smeared bands, primer dimers, nonspecific amplification, or no amplification. Optimizing PCR temperature settings can increase specificity and efficiency, preventing drawbacks and inconclusive results. Gradient PCR is a technique similar to conventional PCR that allows for simultaneous testing of a range of annealing, denaturation, or extension temperatures to identify the optimal temperature(s) to achieve the desired amplification results. Using an online Tm calculator, we estimated the appropriate annealing temperatures for the forward and reverse primers. Typical inputs using Tm calculators involve identifying the specific polymerase or kit one is using, primer concentration (nM), and the forward and reverse primer sequences. After determining the ideal annealing temperatures for each primer, a range of temperatures was selected to identify the best annealing temperature for a primer set. We used gradient PCR to achieve optimized results for the amplification of multiple domains (e.g. V3-V4 and V6-V8) of the 16s rRNA gene. Gel electrophoresis was used to visualize the PCR products. Once the amplification of the target 16s rRNA gene segment is confirmed, genomic DNA samples purified from the guts of native bees will be sequenced to identify the bacterial species present in the gut microbiome. To conclude, gradient PCR is an efficient and effective way to optimize PCR to specifically amplify a target gene.

ORAL PRESENTATIONS

ABSTRACTS

CHEMISTRY, BIOCHEMISTRY, PHYSICS & SCIENCE EDUCATION

CBPSE -01

08:30-08:45 AM | LSA ROOM 120/121

Brand value of pain-relievers

Elrod, Hannah
Lenoir-Rhyne University

Brand value of pain-relievers: a comparative analysis of Excedrin® and generic combination analgesics
Combination pain-relievers such as Excedrin® and its generic equivalents contain a combination of acetaminophen, aspirin, and caffeine and are commonly used to treat headaches and migraines. While generic versions of Excedrin are available at lower prices, consumers often prefer brand-name products due to concerns about efficacy and quality. The goal of this research is to analyze if the efficacy and quality of Execdrin are worth the extra cost or if the generic versions are just as effective at a lower price. A Vankel VK 7000 dissolution apparatus was used to achieve controlled dissolution of the tablets at a constant temperature of 28.5°C and spin speed of 100 rpm for 60 minutes in 900 mL of aqueous 0.1 M HCl to mimic stomach conditions. Samples were acquired from the dissolution bath at regular time intervals within the 60-minute test time and filtered to remove any undissolved residues. A PerkinElmer Flexar HPLC Series 200 with a UV/VIS detector was used to quantify the amount of active and inactive ingredients. Results from visual observation of dissolution over time combined with HPLC Chromatographs of the brand name and generic pills at each time interval will be compared to assess the dissolution efficacy and quality of each tablet. Preliminary results from the dissolution study and HPLC analysis suggest that Excedrin may be more effective than generic brands.

ORAL PRESENTATIONS

ABSTRACTS

CBPSE -02

08:45-09:00 AM | LSA ROOM 120/121

Density Functional Theory calculations on Sc2C mxene electride

Morris, Da'Shawn* Bhoj Gautam, Chandra Adhikari
UNC Fayetteville State University

Sc2C is a two-dimensional Mxene electride, composed of layered scandium and carbon atoms, that has electrons localized in the crystal's lattice sites instead of atomic sites. Sc2C crystallizes to a trigonal crystal structure with its atoms arranged in a hexagonal lattice system. We aim to investigate Sc2C by looking at its electronic structure, magnetism, and optical properties. We optimize the crystal structure minimizing the energy and force using the Vienna Ab initio Simulation Package (VASP). The optimized structure is then used to calculate the material's power diffraction pattern, density of state, bandgap, and magnetism. We use Visualization for Electronic Structural Analysis (VESTA) for crystallographic analysis. Unlike most MXenes, which are metallic in nature, Sc2C MXene has been reported to be a small band gap semiconductor. Magnetic analysis concludes that Sc2C is a nonmagnetic compound. It has high but tunable electrical conductivity, excellent thermal conductivity, a larger surface-to-volume ratio, and exceptional mechanical strength as needed in the advancement of current technology.

CBPSE -03

09:00-09:15 AM | LSA ROOM 120/121

In silico screening of BACE1 inhibitors: A molecular docking approach to target amyloid-beta formation in Alzheimer's Disease

Owens, Jackson*
Lenoir-Rhyne University

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by cognitive decline, synaptic dysfunction, and the accumulation of amyloid-beta (Aβ) plaques. Aβ plaques originate from the sequential cleavage of amyloid precursor protein (APP) by β-secretase (BACE1) and γ-secretase, making BACE1 a promising target for therapeutic intervention.

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ABSTRACTS

Given the challenges in developing effective AD treatments, computational approaches offer a cost-effective and time-efficient method for identifying potential drug candidates before experimental validation, accelerating the discovery of viable therapeutics. This study utilizes computational molecular docking to identify and analyze potential BACE1 inhibitors using AutoDock Vina and PyMOL. High-resolution BACE1 crystal structures were obtained from the Protein Data Bank (PDB), and a selection of synthetic and natural compounds was screened for binding affinity and interaction stability within the active site of BACE1. Molecular docking simulations were performed to predict binding energies (ΔG kcal/mol) and identify key molecular interactions, including hydrogen bonding, hydrophobic interactions, and π-π stacking. The most promising inhibitors were further assessed for drug-likeness and pharmacokinetic properties using ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) analysis. This computational approach provides a theoretical framework for identifying novel BACE1 inhibitors, offering insights into potential therapeutic candidates for Alzheimer's disease. While these findings must be validated through experimental synthesis and biological assays, they highlight the potential of computational modeling in accelerating the drug discovery process for neurodegenerative diseases.

CBPSE -04

09:15-09:30 AM | LSA ROOM 120/121

First Principles Study of TI4N3 MXene

Garrett,Shereiff *, Bhoj Gautam, Chandra Adhikari
1.Department of Mathematics and Computer Science, Fayetteville State University, Fayetteville NC 28301
2. Department of Chemistry ,Physics and Materials Science, Fayetteville State University, Fayetteville NC 28301

Ternary layered nitrides Ti4AlN3 powders can be synthesized from the raw materials Ti, Al and TiN by mixing them in the ratio of 1:1.2:2.7, adding ethanol, ball milling at a speed of 400 revolutions per minute for about four hours, then putting in an oven for a day and then sintering the sample at 15000C[1]. Thus produced MAX phase called 2.7 Ti4AlN3 is a good purity Ti4AlN3. The well-known top-down method of itching aluminum layers results in the production of layered Ti4N3 MXene, which is completely stable than other titanium nitride MXenes. Ti4N3 MXene crystalized to a hexagonal $P6_3/mmc$ structure. Like Ti4AlN3 MAX phase,

ORAL PRESENTATIONS

ABSTRACTS

the Ti4N3 MXene are also metallic. Interestingly, the Ti4N3 MXene is ferromagnetically aligned unlike nonmagnetic Ti4AlN3 MAX phase. The band structure for the up spin significantly differs from the down spin. The density of states of Ti4N3 is dominated by 3d states of Ti and 2p states of N. One witnesses strong hybridization of Ti-3d states and N-2p states in the valence band, while the Ti-3d states heavily dominate in the Fermi level and conduction band.

Reference: [1] M.F.U. Din et al. Journal of Advanced Dielectrics 9 (1), 1950008 (2019).

This work is supported by the Department of Energy BES-RENEW award number DE-SC0024611.

CBPSE -05

09:30-09:45 AM | LSA ROOM 120/121

Bioelectric potential of bacterial waste via microbial fuel cell

Russick, Julian, Darryl Bing, Ph.D.
Department of Physical Science, Durham Technical Community College

A microbial fuel cell (MFC) uses the process of anaerobic respiration undergone by microbial life-consuming glucose in an oxygen-free environment. The reduction-oxidation reactions during anaerobic respiration create a need for an electron acceptor that is not oxygen, allowing for an implemented anode-to-cathode pathway that allows for a directed electric current. In previous research, wastewater samples from breweries were studied in the MFC as a medium containing still-living yeast cells that could undergo anaerobic respiration.

While studying the wastewater samples it was found that each respective sample correlated with a specific type of beer produced a higher and more steady voltage under optimum pH and temperature conditions. More recently a new MFC was constructed with an increased volume for the anode and cathode chamber. The new fuel cell showed a sustained voltage of around 350mV for over an hour with only 10mg of dry baker's yeast (Saccharomyces Cerevisiae) at a cell count of 18 million cells.

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Most recently, the study has changed its scope of focus from that of brewery waste to septic waste or human waste by focusing keenly on the bioelectric potential of Escherichia coli. This change aims to examine the potential use of septic waste as a producer of clean and renewable electricity via the examination of E. Coli. It is hypothesized that due to the much faster replication rate of E. Coli (doubling every twenty minutes) compared to that of yeast (doubling every 90 minutes), it will produce a higher voltage at a faster rate per amount of initial cells used in the MFC.

CBPSE -06

10:00-10:15 AM | LSA ROOM 120/121

Ion-Doped Perovskite Materials: Enhancing Photoluminescence for LED and Sensor Innovations

Murray, Thomas, Adhikari Menuka , Zhiping Luo
Fayetteville State University

Perovskite materials have attracted significant attention due to their exceptional photo-luminescent properties, making them highly promising for sensing and LED applications. This study focuses on enhancing the red emission photoluminescence efficiency of $Cs_2M_2F_6$ (M = Hf, Zr, Sn, Ti) vacancy-ordered hexagonal perovskites through targeted Mn4+ and Li^+ ion doping. The synthesized materials were systematically characterized to assess their structural integrity and optical performance. X-ray diffraction (XRD) analysis confirmed that the synthesized materials with a hexagonal structure. Scanning electron microscopy imaging revealed thin plate particles. Further photoluminescence studies conducted using spectrofluorometer analysis highlighted the impact of Mn4+ and Li^+ doping on the emission characteristics. These findings contribute to a deeper understanding of the Mn4+ and Li^+ doped $Cs_2M_2F_6$ perovskite materials and their potential for advanced optoelectronic applications, particularly in the fields of luminescent sensing and next-generation LED technologies.

ORAL PRESENTATIONS

ABSTRACTS

CBPSE -07

10:15-10:30 AM | LSA ROOM 120/121

Testing different alcohol substrates for a pedagogical multistep synthesis involving alcohol bromination and Williamson ether synthesis

Kellar, Kyle*, M. Mahlon Dyer Jr., Nicholas M. Woodlief, Sarah K. Goforth
Campbell University

Different alcohol substrates have been tested for a pedagogical multistep synthesis laboratory experiment involving alcohol bromination followed by Williamson ether synthesis (WES). The bromination step for both constitutional isomers 1-phenylethanol and 2-phenylethanol was partially optimized according to temperature and acid equivalents. Having the hydroxy group at the benzylic position in 1-phenylethanol led to higher yields and conversions than for 2-phenylethanol. WES trials on the alkyl bromide produced from 1-phenylethanol gave moderate yields of an easily isolated mixture of target ether and styrene that could be quantified by GC. Bromination of 4-biphenylmethanol was optimized according to acid equivalents, temperature, and time, producing a solid brominated product with good yields and high conversions. This product could be successfully reacted with either MeOH or EtOH to form the respective methyl or ethyl ethers based on proton NMR peak integrations. Both target ethers could be isolated by extraction using a mixture of EtOAc and a nonpolar solvent such as pentane or hexane.

ORAL PRESENTATIONS

ABSTRACTS

CBPSE -08

10:30-10:45 AM | LSA ROOM 120/121

Exploring the Thermal Behavior of Mo1.33C i-MXene: Phase Transitions and Surface Chemistry

Makani Nisha*, Wilson Angela, Bretana Alex**, Rai Binod**, Gautam Bhoj*
Department of Chemistry, Physics and Materials Science, Fayetteville State University*, Savannah River National Laboratory, Aiken, South Carolina**

Quaternary i-MAX phases, atomically layered solids with the chemical formula (M'2/3M"1/3)2AlC, were recently discovered and have since garnered significant attention for their magnetic properties, piezoelectric characteristics, and more. Few studies have explored the preparation of i-MXenes using exfoliation and delamination techniques, with specific samples exhibiting the highest capacitance values. Although their structural and magnetic properties have been examined, there remains a need for a deeper understanding of their thermal properties. To address this in this study, we prepared i-MAX phases using molybdenum as M1 and rare earth elements M2 as Er. These prepared materials were subsequently processed with the mild etching method to produce i-MXene. We analyzed i-MXenes, namely (Mo2/3Er1/3)2C using XRD, XPS, Raman spectroscopy, SEM, EDS, TGA, and DSC to understand their fundamental properties and stability under thermal stress. From the XRD and Raman data, we observed that the solid-solution i-MXene shows that, along with Al, a certain percentage of the Er elements were also etched, as confirmed by the XPS and EDS profiles.

Here, we provide detailed insight into the i-MXene by performing the TGA up to 1000°C and DSC up to 200°C under an inert atmosphere to understand its degradation behavior at elevated temperatures. The thermal behavior, including kinetic activity and phase change within this temperature range, indicates significant insights into surface terminations such as hydroxyl (-OH), oxygen (-O), fluoride (-F), and intercalated species in i-MXenes. Endothermic and exothermic peaks observed in the DSC measurement for i-MXenes in the 80 to 100°C range suggest that the material is experiencing structural changes with temperature. The findings provide insights into the thermal behavior and stability of these novel i-MXenes, contributing to the advancement of their use in various technological applications.

ORAL PRESENTATIONS

ABSTRACTS

CBPSE -09

10:45-11:00 AM | LSA ROOM 120/121

Synthesis and characterization of Mo2Ti2C3Tx MXene via strong and mild synthesis methods

Mia Thompson*, Nisha Makani, Bhoj Gautam
Fayetteville State University

MXenes are two-dimensional nanomaterials that have been under investigation for their unique properties such as high electrical conductivity, large surface areas, and versatile surface chemistry. Thus, they are promising candidates for various applications, particularly supercapacitors, with double transition metal carbides and nitrides being of particular interest. Selective etching of MXenes from their parent MAX phase remains challenging. In our research, we have explored strong (HF) and mild (KF/HCl) etching method and successfully etched the Mo2Ti2AlC3 MAX phase. X-ray diffraction (XRD) confirmed the removal of the aluminum layer from the parent MAX phase. The XRD pattern showed a peak shift from 15.2° to lower degree, indicating successful etching of the MAX phase. The diffraction peak at 41.5° corresponds to Mo2Ti2AlC3 with impurities such as AlMo2. The reduction in peak intensity after synthesis further confirms successful MXene formation. There were diffraction peaks inconsistent with literature suggesting other impurities in our sample, and peaks suggesting remaining Al impurities. Scanning electron microscopy (SEM) showed the presence of separated flakes, confirming successful delamination. Raman spectroscopy revealed peaks indicating the presence of Mo/Ti-C vibrations at 382 cm-1 and peaks suggesting exfoliated MXene layers at 428 cm-1. These findings contribute to the advancement of MXene synthesis, which is crucial for applications in energy storage, and highlight the influence of etching conditions on MXene quality. Future work will focus on evaluating the structural and chemical stability of the synthesized MXene under gamma radiation exposure.

This work was supported by DOE BES-RENEW award number DE-SC0024611

ORAL PRESENTATIONS

ABSTRACTS

ECOLOGY, BOTANY & ZOOLOGY

EBZ-01

08:30-08:45 AM | LSA ROOM 129

Algebraic methods for exploring phylogenetic networks

Ramos, Demmi
Lenoir-Rhyne University

Phylogenetics is the study of evolutionary relationships between organisms. Our goal is to reconstruct the evolutionary history of collections of species by building phylogenetic trees (family trees) from biological data. While mathematically interesting, trees are often too simple to model the complex nature of real gene transfers. This leads to the study of phylogenetic networks, which incorporate hybridization, allowing separate species to come together. This talk explores assigning algebraic invariants to phylogenetic networks in order to find the network that best explains the data given. One approach to assigning these invariants involves using matrices of conditional probabilities to describe models of DNA sequence evolution.

EBZ-02

08:45-09:00 AM | LSA ROOM 129

Behavior and multimodal communication associated with mating in red-headed meadow katydids (Orchelimum erythrocephalum)

Bui, Tiffany Y.*, Trip Thomas, Jennifer A. Hamel
Elon University

Many animal species, ranging from elephants to insects, communicate using more than one kind of signal. Such multimodal communication can enhance the transmission of signals through environments and/or provide different kinds of information to receivers. Insects called katydids (Orthoptera: Tettigoniidae) are effective models for studying multimodal communication because males attract mates by producing airborne calls, and males and females of some species also produce vibrational signals called tremulations. Red-headed meadow katydids (Orchelimum erythrocephalum) produce both calls and tremulations, but the functions of each

ORAL PRESENTATIONS

ABSTRACTS

signal type are not fully known. As a first step toward understanding why individuals of this species use signals in multiple modalities, we observed and recorded behavior in three different social contexts: solitary males, males with other males, and males with females. We recorded and quantitatively described behavior from katydids on potted plants in an acoustically and vibrationally isolated arena. We recorded katydid behavior using a video camera and detected calls and tremulations using a microphone and microaccelerometer. We predicted that the numbers and rates of calls and tremulations produced by red-headed meadow katydids should vary across different social contexts, reflecting context-dependent functions. Our findings show that solitary males do not produce calls or tremulations; males call and tremulate during male-male interactions; and during male-female interactions, males call and both males and females tremulate, including prior to mating. We discuss hypotheses about potential fitness benefits of multimodal communication for this species.

EBZ-03

09:00-09:15 AM | LSA ROOM 129

Using different plant growth regulators and their combinations to improve rooting in cotton (Gossypium hirsutum) stem cuttings

Yang, Elijah*, Michael R. Stiff
Lenoir-Rhyne University

Cotton (Gossypium hirsutum) is the most important textile resource in the United States. It produces a renewable fiber used to make a variety of goods such as clothing and other fabrics. It takes 160 days for cotton to fully mature to produce fiber, which is time-consuming and costly. Propagation of plants by stem cutting can speed up the production of new cotton plants. Cloning by stem cutting is done by removing a small piece of stem from a plant and growing it separately, usually needing plant growth regulators, such as auxins, cytokinin, gibberellins, ethylene, and abscisic acid, which can help the stem make adventitious roots. Cloning is also useful to investigate gene function in plants. This is due to each stem cutting being genetically identical, simplifying the connection of specific genes to function.

A more efficient method for cloning cotton plants could speed research by optimizing the combinations of these plant growth regulators to use in cotton stem cuttings. The main objective of this study is to test the effect of different plant growth regulators, and different combinations of them, on adventitious root formation and length. Stem cuttings from cotton seedlings (G. hirsutum cv. Phytogen 210) were grown in MS medium with different combinations of plant growth regulators in 0.5% Phytagel to observe the roots.

ORAL PRESENTATIONS

ABSTRACTS

The plant growth regulators under study are two cytokinins, benzyl-amino-purine (BA) and kinetin (KIN) and three auxins, indole-3-acetic acid (IAA), idole-3-butyric acid (IBA), and naphthaleneacetic acid (NAA). The effectiveness of different auxins for generating adventitious roots will be of particular interest.

EBZ-04

09:15-09:30 AM | LSA ROOM 129

Synthetic Bird Song

Touma, Mason*; Gammon, David E.
Biology Department, Elon University

Unlike most taxonomic groups, songbirds produce mostly pure-tone songs that can be represented with a simple sine wave that modulates its frequency and amplitude. Using the mathematical formula for sine waves, and high-resolution frequency and amplitude measurements taken from the songs of actual northern cardinals (Cardinalis cardinalis), we coded Python software to generate synthetic, high-fidelity birdsong.

A field playback study showed that wild cardinals responded to synthetic songs as if they were natural. We are still working out software bugs, including what to do about misleading acoustic measurements that result from background noise and echoes within our model sounds, and the limited range of frequencies that result from using Short Time Fourier Transformations. In the long-term future, our program has the potential to open new avenues for scientific research, such as an app that can allow users to generate their synthetic birdsong.

ORAL PRESENTATIONS

ABSTRACTS

ENGINEERING

ENG-01

09:30-09:45 AM | LSA ROOM 127

Air brake for 6-inch diameter rocket

Shade, Allan
Lenoir-Rhyne University

This project presents the design and implementation of a 3-fin, 6-inch diameter air brake system for a high-power rocket. The air brake, measuring 5 inches in length and 5.85 inches in diameter, is engineered to provide controlled deceleration, ensuring the rocket maintains a stable and predictable velocity throughout its deployment. Positioned inside the rocket's airframe, just forward of the fin can, the air brake is securely riveted for enhanced structural integrity and aerodynamic stability. The system operates by deploying three aerodynamic surfaces to increase drag when needed, mitigating excessive velocity and improving flight control. This design aims to enhance the rocket's performance by preventing velocity overshoot, and optimizing overall flight dynamics.

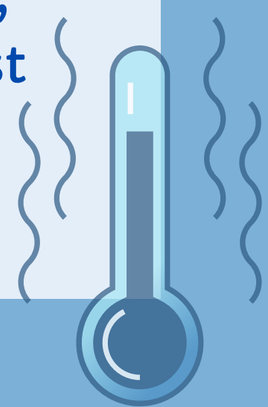
ENG-02

11:00-11:15 AM | LSA ROOM 127

Data Analysis: Temperatures Changing in Raleigh for the past 30 years

Harper, Ashley*, Sidong Zhang
Campbell University

Comparing the daily temperature data in Raleigh using statistical analysis methods, there is clear evidence that there is a significant increase in temperatures in the past 30 years.



ORAL PRESENTATIONS

ABSTRACTS

MICROBIOLOGY

MICRO-01

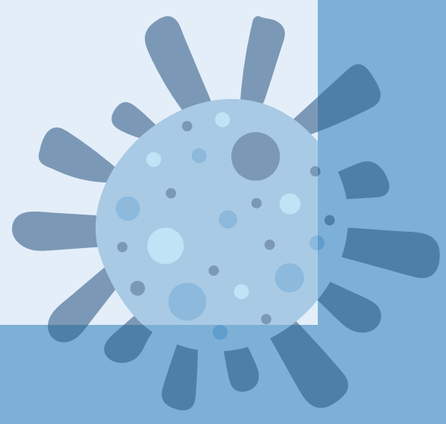
10:00-10:15 AM | LSA ROOM 129

Isolation and identification of antimicrobial secondary metabolites produced by the mold Pestalotiopsis sp.

Fisher, Christina*, Gezell Alberto, Graleigh Hildebran, Andy Steele, Josh Ring, Dan Grimm
Lenoir-Rhyne University

Human infection caused by antimicrobial-resistant (AMR) bacteria has become a growing global health concern, resulting in approximately 4.95 million deaths each year, a number that is predicted to rise to ten million annually by 2050. Despite the increasing prevalence of AMR pathogens, the development of new antimicrobial compounds has declined over the past four decades. The subsequent decrease in the annual number of FDA submissions for new antimicrobial drugs challenges us to lead the search for new antibiotics. Previous research identified sixteen endophytic fungi capable of inhibiting the growth of disease-causing pathogens, raising the question of which specific compounds were responsible for this inhibition.

Here, we investigate secondary metabolites produced by Pestalotiopsis sp., a fungal pathogen previously isolated from the interstitial spaces of Albizia julibrissin (mimosa tree) leaves. Preparative thin-layer chromatography (PTLC) and gas chromatography-mass spectrometry (GCMS) were used to separate and identify secondary metabolites from Pestalotiopsis sp. extract. Two pyrrolo-containing molecules and a diketopiperazine were found, both known to inhibit the growth of bacterial pathogens. These findings highlight the potential of Pestalotiopsis sp. as a source of antimicrobial compounds.



ORAL PRESENTATIONS

ABSTRACTS

MICRO-02

10:15-10:30 AM | LSA ROOM 129

Isolating Antibiotics: Assessing the Antibiotic Potential within Colonies of Solenopsis Invicta

Stearns,Leeann*, Amanda Beal, Allison Cannady, Dr. Stephanie Mathews, Dr. Michelle Thomas
Campbell University

This study explores the potential for antibiotic producing bacteria in the external microbiome of the invasive fire ant species Solenopsis invicta. Microbes were isolated from the exterior of the ants collected from a single mound and then assayed for antimicrobial activity. Twenty-seven unique colonies were initially tested, with twelve showing inhibition against P. putida. After further screening, six isolates that showed inhibition of numerous bacterial test strains, were identified using 16s rDNA sequencing and phenotypic testing. Thus far, putative identifications of isolates include Burkholderia spp., Lelliottia spp., Rhodococcus erythropolis and Serratia surfactantfaciens. Ongoing additional genotypic and phenotypic testing will help confirm species identity. Methods for chemical extraction of the antimicrobials will be explored and extracts will be tested against bacterial test strains. This investigation contributes towards characterizing external microbes found on Solenopsis invicta providing further insight into their invasiveness as well as discovering new antimicrobials.

MICRO-03

10:30-10:45 AM | LSA ROOM 129

Genomic sequencing and toxicity testing of AGM01 on nematode Caenorhabditis elegans

Miller, Anna*, Mathews Stephanie
North Carolina State University

Increasing antibiotic resistance is a prevalent problem in clinical settings, and is quickly making many common antibiotics obsolete. A bacterium, AGM01, was previously isolated from soil and shown to inhibit the growth of Bacillus subtilis, Enterococcus raffinosus, and Staphylococcus epidermidis. Initial findings proved promising but the identity and safety of the antibiotic products of AGM01 is still unknown.

ORAL PRESENTATIONS

ABSTRACTS

This study further examines characteristics of AGM01 by genomic sequencing and testing the toxicity of AGM01 crude organic extract of a possible novel antibiotic from AGM01, a bacterium isolated from soil that has previously been shown to inhibit growth of Bacillus subtilis, Enterococcus raffinosus, and Staphylococcus epidermidis. Genomic DNA was sequenced using Illumina and resulting contigs were assembled and annotated using BV-BRC. Predicted gene function was analyzed for those associated with production of antibiotics. Toxicity was assessed by performing fecundity assays on synchronized model organism Caenorhabditis elegans after treatment with crude organic extract from bacterium AGM01 to identify any negative effects on growth or reproduction. The effect of AGM01 extract for 1 hour on C. elegans (n=5) at three concentrations (0.02 g, 0.06 g, and 0.01 g) was tested, as well as media only and solvent only controls. Nematode offspring were counted to assess effects. AGM01 extract did not have an inhibitory effect on C. elegans growth at various concentrations (all $p>0.05$). These results indicate that AGM01 does produce antibiotic compound(s) which does not inhibit growth or reproduction of C. elegans at the concentrations tested. Future work will include chemical characterization of the antibiotic compound(s) produced.

MICRO-04

10:45-11:00 AM | LSA ROOM 129

Combining the histone deacetylase inhibitor, valproic acid, with equine herpesvirus type 1 to evaluate synergistic cytotoxicity

Mayer, Jacob*, Arthur Frampton, Ph.D
University of North Carolina Wilmington

Prostate cancer is the second most frequent cancer and the fifth leading cause of cancer death in men globally. An intriguing option for cancer treatment is oncolytic virotherapy, in which native or genetically modified viruses are used as anti-cancer agents. In this study, we investigated the oncolytic potential of 4 strains of the animal virus equine herpesvirus type 1 (EHV-1) on human prostate cancer cell lines, PC-3, LNCaP, and C4-2B. We first measured the amount of virus mediated cell death at 24, 48, and 72 hours. Cell death steadily increased in each cell line from 24-72 hours with total cell death at 72 hours on PC-3 ranging from 84% to 90%, 75% to 85% on LNCaP, and 83% to 88% on C4-2B. We also infected the normal prostate epithelial cell line (RWPE-1) with the four EHV-1 strains and observed cell death ranging from 58% to 83% after the 72-hour infection. In addition to the cell death assays, the amount of virus produced in these cell lines was also measured at 24, 48, and 72 hours. To date, we have collected virus yield data for the 24–72-hour time points with the 4 EHV-1 strains on the 3 cancer lines and the yields range from 1.0 x 10^5 pfu/mL to 2.3 x 10^7 pfu/mL while on the RWPE-1 cell line yields range from 1.0 x 10^2 to 1.5 x 10^5 indicating EHV-1 can productively infect the three prostate cancer cell lines.

ORAL PRESENTATIONS

ABSTRACTS

We are currently assessing the combination of the histone deacetylase inhibitor, valproic acid (VPA), with EHV-1 to evaluate synergistic cytotoxicity. Cell death has increased with a 24-hour VPA pretreatment prior to a 24-hour EHV-1 infection at MOI's of 1, 3, and 10. Total cell death at an MOI of 10 without the VPA pretreatment was 58% and with VPA, 80%.

MICRO-05

11:00-11:15 AM | LSA ROOM 129

Low magnetic field strength 19F NMR of breast and formula milk and exanimation of potential anti-microbial activity

Haché, Allison R*, Vijay C Antharam, Lauren Klabonski
Methodist University

The safety and quality of infant nutrition is of utmost importance, as it determines the well-being of future generations. There is much debate on whether maternal milk or commercial formula is more advantageous to infants. Providing scientific insights on infant nutrition could empower parents to make informed decisions and possibly improve the manufacture of baby formula.

Multiple chemical analysis and biological assays will be applied to make comparisons. The response of two breast milk donors (B1and B2) and a formula brand for infants will be measured under a low magnetic field strength 80MHz (1.8T) NMR to assess difference in proton and fluorine resonance signals. 1-D proton and 1-D fluorine NMR will be collected on samples treated with 2M acetic acid to facilitate precipitation of proteinaceous components of extraneous milk solids; the resultant filtrate from gravity filtration will then be collected and run on a SpinSolve 80MHz tabletop NMR spectrometer for a minimum of 4000 scans. Difference spectra and broad NMR linewidths will be compared to ascertain differences in proton and fluorine environments from two donor samples and one store-brought commercial product. The NMR spectra detecting both fluorine and proton signals can provide valuable insight into chemical differences between individual breast milk donors versus those industrially manufactured.

Furthermore, the B1, B2, and Similac samples will be assessed for antimicrobial properties against water as a control. Antimicrobial action will be determined by whether the samples inhibit the growth of six different common gastrointestinal (GI) pathogens.

POSTER PRESENTATIONS

ABSTRACTS

CELL BIOLOGY, MOLECULAR BIOLOGY, & PHYSIOLOGY

CBMBP-P1

Dissecting substrate features recognized by UBE2O

Beonka Sharpe 1,2*, Michael Rale Ph.D.1, Sichen (Susan) Shao, Ph.D.1
1Department of Cell Biology, Harvard Medical School, Boston, MA. 2Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville, NC.

The ubiquitin-proteasome system is essential for maintaining cellular homeostasis as it targets proteins for degradation. However, before proteins are degraded, they must first be recognized and modified by a series of proteins known as ubiquitin activators (E1), ubiquitin conjugators (E2), and ubiquitin ligase (E3). These add the small protein ubiquitin, flagging them for the proteasome. UBE2O (Ubiquitin Conjugating Enzyme E2O) is a unique ubiquitin ligase that acts as both an E2 and E3 ligase, but how UBE2O selects its targets is currently unknown. To understand this, the Shao Lab has been investigating how UBE2O acts on a known target, the protein IFRD2 (Interferon Related Developmental Regulator 2). Alphafold-3 suggests that UBE2O binds the C-terminal helix of IFRD2, which we hypothesize is the recognition feature for UBE2O-targeted degradation. We investigated this hypothesis by a) determining whether IFRD2's C-terminal helix is necessary for UBE2O ubiquitylation and b) determining whether this C-terminal helix is sufficient to have UBE2O modify a new substrate that is not usually a target. To test our hypothesis, we cloned and purified different IFRD2 and GFP (non-normal target) substrates with and without the C-terminal helix (ΔCtH). As it is known that UBE2O more efficiently ubiquitylates already ubiquitylated targets, we also generated IFRD2 and GFP variants fused to ubiquitin. Using biochemical ubiquitylation assays with purified UBE2O, our data shows that IFRD2 alone undergoes less efficient ubiquitylation, supporting previous findings by the Shao Lab. The same ubiquitylation pattern is observed for IFRD2-ΔCtH, indicating that the C-terminal helix of IFRD2 is crucial for UBE2O substrate recognition. In addition, when the C-terminal helix of IFRD2 is fused to an unrelated protein, GFP, UBE2O will now recognize and ubiquitylate the fused protein. In conclusion, the C-terminal helix of IFRD2 is a vital recognition feature for the UBE2O-mediated ubiquitylation of IFRD2 and an unrelated substrate.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P2

The effect of naringenin on insulin resistant adipocytes

Heck, Cynthia*, Yashomati M Patel
University of North Carolina at Greensboro

Obesity currently affects over 40% of the adult population in the United States and millions of children nationwide. Along with atherosclerosis, insulin resistance, a hallmark symptom of type II diabetes mellitus, is another serious health complication of obesity. As the prevalence of obesity increases, the need for alternative treatments that are safe and effective is critical. Previous studies have recognized naringenin, a natural citrus flavanone, for its ability to regulate glucose and lipid metabolism. While previous studies have been conducted in insulin sensitive models showing naringenin's ability to prevent weight gain, we have investigated the role naringenin plays on lipid metabolism and glucose uptake in insulin insensitive adipocytes. We aimed to study naringenin's effects on the glucose and lipid metabolism using lipid-laden mouse fat cells (adipocytes). This research will advance our understanding of how naringenin can affect the lipid-laden insulin resistant adipocytes that are present in metabolic disorders such as obesity and type II diabetes and justify the possibility of using naringenin as a natural treatment for weight loss and alleviate symptoms of type II diabetes.

CBMBP-P3

MXene nanocomposite-based biosensor for organophosphate detection

Florentino, Jose*, Wu, Jett*, Bhoj R Gautam, Nisha Hiralal Patel Makani, Shubo Han, Bhoj R Gautam, Nisha Hiralal Patel Makani
Fayetteville State University

Organophosphorus pesticides (OPs) are widely used in agriculture to control various insects and pests, which pose significant health risks. Detecting OP residues is essential due to their harmful effects, driving the development of biosensors for their detection, which holds significant scientific importance. In this work, we developed an MXene-based electrochemical biosensor for detecting OPs in solutions, utilizing Ti_3C_2 MXene nanosheets integrated with chitosan and acetylcholinesterase (AChE). MXenes, known for their high electrical conductivity, were used to enhance the biosensor's sensitivity.

POSTER PRESENTATIONS

ABSTRACTS

The electrochemical behaviors of the CS-Ti3C2-AChE/GCE biosensor were studied using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). In our study, we used chlorpyrifos as the target OP, and based on DPV (differential pulse voltammetry) measurements, we found that our biosensor demonstrated excellent detection performance under optimal conditions. The DPV waveforms revealed a clear correlation between increasing OP concentrations and peak current, as compared to the blank solution with no OP. Additionally, the biocompatibility and non-toxicity of the biosensor, along with the high conductivity and large surface area of Ti3C2 nanosheets, contributed to its reproducibility, stability, and resistance to interference. This makes the sensor highly suitable for detecting OPs in real-world samples, showcasing its potential for practical applications.

CBMBP-P4

Mutagenesis of β-glucosidase (BglB) for increased enzymatic stability via single-point mutation: Analysis of the catalytic efficiency and thermostability of M323C via enzymatic activity assays

Trivett, Laura*, Evan Reynolds.
Campbell University

The Design to Data project is a crowd-sourced course based undergraduate research (CURE) project. The project involves characterizing the kinetics and thermostability of mutants of the enzyme β-glucosidase (BglB) from Paenibacillus polymyxa. The objective was to design and analyze a new BglB mutant to add to a dataset to inform protein design algorithms. A robust cloning method, Kunkel mutagenesis, was used to introduce the mutation. Protein expression. The mutant enzyme was then expressed in E. coli and purified using Ni affinity chromatography. Enzyme catalytic efficiency and thermostability were studied using activity assays with the colorimetric substrate para-nitrophenol-β-D-glucopyranoside. Activity was followed by measuring absorbance at 420 nm of the nitrophenyl group as it's cleaved off the substrate. The mutation chosen showed a significantly lower catalytic efficiency than the wild-type, (6.28 mM-1min-1 and 120.7 mM-1min-1, respectively), and a higher thermostability (T50 °C = 37.7 and 33.6, respectively). These results, along with results from students across the nation, have created an expansive dataset which can train AI programs to better predict enzymatic activity after mutations thus closing the gap between knowledge of how structure impacts function.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P5

Exploring the antioxidant capacity of Māmaki Extracts

Klabunde, Noelle
University of North Carolina at Greensboro

Māmaki is a culturally important Hawaiian plant with many traditional medicinal uses. Still, no in-depth research has been done to explain why or how Māmaki functions as a medicinal plant. Ferric reducing power of plasma (FRAP) is a widely used analytical method to measure the total antioxidant capacity of biological samples and various natural compounds and their extracts. This study used the FRAP assay to examine the antioxidant capacity of Māmaki extracts. Six different concentrations of māmaki extracts (200 µg/mL, 100 µg /mL, 50 µg /mL, 25 µg/mL, 10 µg /mL, and 5 µg /mL) along with FRAP standards were tested in a 96-well plate. Our standard curve's regression ratio (R^2) is close to 0.99, indicating high accuracy. This standard curve was used to calculate the antioxidant capacity of the Māmaki extract samples. Our results showed that Māmaki extracts at concentrations as low as 10 ug/mL exhibited significant ferric-reducing capacity, indicating antioxidant capacity. Our study is the first to report that Māmaki extracts possess ferric-reducing capacity, which may partially explain their mechanism of action for health benefits.

CBMBP-P6

Gene enrichment hallmark pathways show that māmaki extract has anti-inflammatory effects on human aortic endothelial cells

Abouzeid Nour*, Ajmal Khan, Gordon Zheng, Yaru Si, Delicia Esther Cardenas Vasquez, Zhenquan Jia
University of North Carolina at Greensboro

Māmaki (Pipturus albidus) is a plant native to Hawaii traditionally used for its medicinal properties, including cholesterol-lowering and anti-inflammatory effects. Despite its extensive traditional use, the molecular mechanisms behind its anti-inflammatory properties remain relatively unknown. Cardiovascular diseases, especially atherosclerosis, are often exacerbated by chronic inflammation of the vascular endothelium and are one of the leading causes of death worldwide.

POSTER PRESENTATIONS

ABSTRACTS

This study investigated the mechanism of action of Māmaki extract on human aortic endothelial cells (HAECs). HAECs were cultured and treated and cultured with 50 μg/ml of Māmaki extract for 24 hours, RNA was isolated and sequenced, and then differential gene expression analysis was performed. Gene set enrichment analysis (GSEA) was conducted in the control and māmaki-treated groups to identify significantly enriched hallmark pathways. Results showed that the hallmark inflammatory response pathways were significantly downregulated in the Māmaki-treated group compared to the control group. Māmaki regulated several signature genes set enriched pathways, such as downregulated inflammatory response pathways, cholesterol homeostasis pathways, and ROS. These findings suggest that Māmaki extract may exhibit anti-inflammatory properties in HAECs by modulating characteristic pathways associated with inflammation and endothelial function.

CBMBP-P7

Predicting 3D protein structure of gene fusions in AMKL patients using AlphaFold

Josling, Maggie, Adam Parsons, Dr. Andrea Perreault - Elon University

The organization of DNA in 3D space is important for gene regulation. Changes in DNA organization and resulting gene expression can have effects on cellular development and function, and have been linked with numerous diseases such as cancer. One way DNA organization may be altered is through binding of fusion proteins containing an intrinsically disordered region (IDR) and DNA binding domain. Fusion proteins form when two portions of independent genes fuse together – which occurs via structural rearrangements (predominantly translocations). This project aims to help fill the gap that recent literature has highlighted regarding the structure of fusion proteins. This will be done using AlphaFold: an artificial intelligence program that uses amino acid sequences to predict 3D protein structure. This research project aims to predict the 3D structure of two gene fusions which were previously predicted by the Perreault lab to be found in Acute Megakaryoblastic Leukemia (AMKL) patients. ColabFold, a software within Google Colaboratory that makes use of AlphaFold, will allow the prediction of numerous proteins simultaneously. A program called ChimeraX will then be used to visualize and analyze the protein structures. Uncovering the protein structure of genes linked with cancer is key for obtaining a clearer picture of tumorigenesis. Thorough analysis of predicted protein structure may illuminate features that may be useful for future drug development for AMKL. Preliminary results have shown that both fusions likely contain intrinsically disordered regions as well as DNA binding domains – possibly suggesting that these combined features play a role in AMKL development.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P8

Investigating the Mechanistic Effect of Heme in Artemisinin-Induced Ferroptosis Using a Cancer Cell Model

Marit Reckmann, McKenzie Peurifoy and Carmony Hartwig - Catawba College

Artemisinin (ART), a novel sesquiterpene lactone endoperoxide-containing molecule, has been studied in recent decades for its potential as an anti-tumor chemotherapeutic drug. The proposed mechanism of action in the tumor cell environment involves dysregulating iron-metabolism and increasing reactive oxygen species (ROS) production and endoplasmic reticulum stress. Heme, an iron-containing porphyrin, has shown to be an effective activator of ART, cleaving the endoperoxide bridge of the ART molecule to produce a carbon-centered radical capable of binding to heme and other molecules. The subsequent production of ROS may in turn trigger ferroptosis, a process that leads to cell death. Research shows that heme serves as a pivotal regulator of chromatin through direct involvement in epigenetic mechanisms.

Thus, many cancer cell types increase the production of heme in a process called heme overdrive. In general, cells require larger amounts of iron for successful proliferation. Our understanding that cancer cells proliferate abhorrently and shift into heme overdrive, may offer a way to exploit this need to instead induce cellular death. We hypothesize that increased levels of heme in cancer cells due to heme overdrive cause ART to selectively target cancer cells through a ferroptosis-induction pathway. Using a resazurin-based cell viability assay, this study aims to investigate these potential synergistic growth inhibitory effects on MCF-7 and HELA cancer cell lines by exposing cells to varied concentrations of heme and ART, alone and in combination, for 24, 48 and 72 hours. Here we report our preliminary findings and discuss future research.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P9

Progression of dyspnea severity in UNCP dysautonomia cohort.

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Dysautonomia is an umbrella term for several disorders affecting the autonomic nervous system. Dyspnea, or shortness of breath, is a commonly reported symptom in dysautonomia patients. This longitudinal patient-reported outcome study investigates whether participants with a self-reported diagnosis of any autonomic disorder experience a change in dyspnea severity over the course of two years (UNCP Institutional Review Board # 39-22). We tested two null hypotheses: (1) dyspnea severity remains unchanged, and (2) quality of life remains unchanged. Participants completed the NIH-PROMIS® Dyspnea Characteristics v1.0 and NIH-PROMIS® Global Health survey instruments in 2023 and again in 2024 to quantify dyspnea severity and its impact on quality of life. We analyzed the data using Excel and R by conducting a paired t-test to compare scores from year one and two. Our results found a significant reduction in dyspnea severity ($p = 4.921e-05$, $t = 4.228$, $df = 109$), with a mean difference of 2.45 (95% CI: 1.30, 3.60). However, we found no change in quality of life, and the null hypothesis for this measure was not rejected. These findings suggest that while dyspnea severity improved over time, this did not translate to a better quality of life. Further testing is needed to explore factors potentially affecting quality of life within the dysautonomia population.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P10

The Effects of Carbon Nanodots on Ultrasonic Vocalizations and Other Behaviors of C57BL/6J and LDLr -/- mice.

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Carbon Nanodots (CNDs) are new nanomaterials widely used in biomedicine for their cost-effectiveness, low toxicity in comparison with other nanomaterials and applications effectiveness, low toxicity in comparison with other nanomaterials and applications such as bioimaging and drug delivery. While multiple in-vitro and in-vivo studies elucidated low-toxicity of CNDs during short period of time (7 days or less), limited information exists regarding their long-term effects on in-vivo models. Specifically, we do not understand the potential toxicity of CNDs on the observable appearance, development, and behavior of an individual. We hypothesized that long term administration of CNDs alters behavior and physiology in laboratory mice. We tested our hypothesis using C57BL/6J mice and LDLr -/- mice and evaluated behavioral and physiological responses to 2.5 mg/kg CNDs over an 8 week period. Specifically, we focused on evaluating the effects of CNDs on Ultrasonic Vocalizations (USVs) as a measure of communicative behavior. Additionally, we utilized two standardized behavioral tests, namely the Open Field Test and the Elevated Plus Maze Test, to analyze alterations in specific behavioral patterns induced by CNDs. Finally, we examined the influence of CNDs on the force strength of mice through a neuromuscular test. We found that CND treated C57BL/6J mice produced fewer USVs than control mice and that CNDs treated mice produced USVs with lower end frequency and maximum frequencies. However, in LDLr -/- mice, we found no difference in calling rate between treatment groups, but CNDs treated mice produced vocalizations with different spectral characteristics. Furthermore, CNDs treated LDLr -/- mice produced call with lower end frequency, maximum frequency, start frequency, frequency at maximum amplitude and minimum frequency. CNDs increased the total floor velocity in the Open Field Test in C57BL/6J mice. We found no differences between treatment groups using The Open Field test or for the Neuromuscular tests. Together these results suggest that the difference in behavioral tests especially in calling rate and changes in spectral characteristics of USVs may reveal that CNDs induce a potential stress response to C57BL/6J mice and LDLr -/- mice.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P11

Towards the structural characterization of predicted carboxyl-terminal dimerization domain of Giardia intestinalis Get5 like protein.

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Membrane proteins are essential to the function of cells. They facilitate regulatory processes such as maintaining cellular homeostasis, cell-to-cell communication, vesicle fusion, and apoptosis regulation. Most membrane proteins are transported co-translationally to the endoplasmic reticulum (ER) by way of the Signal Recognition Particle (SRP) pathway.

One class of proteins exempt from the SRP pathway are TA (tail-anchored) proteins due to their membrane insertion using the C-terminal transmembrane domain (TMD). This property of TA proteins requires them to be transported to the ER post-translationally by way of the Get pathway (guided entry of TA proteins). The Get pathway is found in all lineages of life. In yeast, the GET pathway is composed of several proteins including the Sgt2 chaperone protein that shields the TA protein, the Get4/Get5 heterodimer complex that facilitates the handoff of TA proteins from Sgt2 to Get3, the Get3 homodimer that is responsible for transporting the TA protein to the ER, and Get1/Get2 which are membrane receptor proteins for Get3 that are localized in the ER. Currently, all of our understanding of the GET pathway, both structurally and biochemically, is held to only the yeast and human pathways. The purpose of this study was to characterize the structure of the predicted Get 5-like homodimerization domain of Giardia intestinalis to understand how conserved the Get pathway is outside of opisthokonta. To this end, we utilized gene cloning, bacteria overexpression, and protein purification as our methodology. We confirmed in this study that Giardia intestinalis Get5 protein does form a homodimerization domain. In future research X-ray crystallography will be used to solve the structure of Giardia's Get5 homodimerization to understand the functional conservation of the Get pathway outside of opisthokonts. In conclusion, Giardia intestinalis does form a homodimerization domain, but further research must be done to reach our end objective.

POSTER PRESENTATIONS

ABSTRACTS

CBMBP-P12

PromGen: Designing Synthetic Promoter Sequences via Recurrent Neural Networks to Enhance Gene Therapy

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1 in 5 people develop cancer in their lifetime. Due to treatment inefficiency, cancer is the leading cause of death worldwide. Immunotherapies show 15-20% success and precision medicine 35.9%. Gene therapy is advancing these treatments offering solutions to cure cancer by targeting the genetic causes. However, precise gene expression control is a critical issue hindering gene therapy. Due to this, these gene therapies only have a 28% chance of receiving FDA approval. This issue is driven by poorly designed promoters, DNA segments responsible for controlling gene activation. Currently, promoter design tools are limited in customizing gene activity, achieving only 20% accuracy. PromGen introduces a novel AI promoter design tool based on recurrent neural networks (RNN) to prioritize sequential dependencies for improved accuracy. It's the first AI application that designs promoters based on desired activity levels. Trained on a robust dataset of 12,602 E. coli promoters, PromGen uses a long short-term memory (LSTM) RNN to model the relationship between promoter sequence and activity level.

PromGen optimizes input sequences iteratively through gradient-based techniques to achieve specified activity levels. It explains 80.9% of variance in promoter activity, a 60.9% improvement over current tools. This enhanced precision could drastically improve FDA approval rates for cancer gene therapy and improve treatment efficiency by targeting root genetic causes. PromGen is the first promoter design tool to optimize based on the desired activity level while considering sequential context, allowing for precise expression control with four times the accuracy of current tools.

POSTER PRESENTATIONS

ABSTRACTS

CHEMISTRY, BIOCHEMISTRY, PHYSICS, & SCIENCE EDUCATION

CBPSE-P1

Characterization of delaminated v2C mXenes

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Vanadium-based V2CTX MXenes, known for their tunable electronic properties influenced by surface terminations (-O, -OH, -F), demonstrate exceptional versatility in energy storage applications. Delaminating these nanosheets further increases their surface area, enhancing their suitability for a wide range of applications. In this study, we synthesized V2CTX MXenes using the V2AlC MAX phase with a strong etching method and characterized them using XRD, SEM, and Raman spectroscopy. The MXene sheets were delaminated with tetra-butyl ammonium hydroxide (TBAOH) and sonication, which separated the layers and resulted in a stable suspension of V2CTX MXene flakes, forming a pale-yellow colloidal solution. The XRD peak at 5.69° signifies the characteristic etching process, and SEM analysis confirms the absence of aluminum, validating the effectiveness of the synthesis method. Raman spectroscopy revealed prominent peaks at 282, 405, 520, and 690 cm-1, confirming the V2C structure. UV-Vis absorbance measurements of the colloidal solution showed absorption in the 450-500 nm range. Our findings, based on the structural and optical characterization of the prepared MXenes, contribute valuable insights to the field of MXenes research.

CBPSE-P2

Photoluminescent characteristics of Nb based MXene quantum dots

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In this study, Nb4C3 quantum dots (QDs) were synthesized via a hydrothermal method. The process involved adjusting the pH of Nb4C3 MXene and applying controlled heating to facilitate the formation of successful synthesis. The optical properties were characterized by using UV-Vis spectroscopy to measure absorbance and emission. To further investigate the stability of these properties over time, a day-wise experiment was conducted. Emission measurements were recorded for days 1-10 to evaluate potential changes in the QDs' optical behavior.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P3

Circular Economy: Applications of Spent Coffee Grounds in Biocomposites

Cassandra Berry, Anne Glenn
Guilford College

This research examines applications of coffee by-products, in particular spent coffee grounds, in the production of biocomposites. The plastic industry produces increasingly alarming quantities of waste that is toxic to the environment, prompting researchers to explore methods to convert food and drink waste into products that can be utilized to create biocomposites, such as biofuel, bioplastics, and biopolymers. This research focuses on the extraction and characterization of lipids from spent coffee grounds, and utilizing those lipids in synthesizing biopolymer films.

CBPSE-P4

Characterization of Immobilized LDH Enzyme

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This study explores the immobilization of the Lactate Dehydrogenase (LDH) enzyme in calcium alginate beads with and without additives such as chitosan and silica to evaluate its enzymatic activity and stability. LDH immobilization offers benefits such as cost-effectiveness, mechanical stress resistance, and ease of separation, making it a valuable approach for enzyme-based applications. The immobilized enzymes were prepared using calcium alginate gels under various conditions, incorporating chitosan or silica to enhance the mechanical properties. Enzymatic activity was assessed using a Cary 60 UV-Vis spectrophotometer, with kinetic data analyzed via spectrophotometry at 340 nm. Results demonstrated that immobilized enzymes exhibit reduced activity compared to the free enzyme, with calcium alginate-silica showing the highest activity among immobilized forms. Additionally, the study highlights the significance of using Tris buffer over phosphate buffer for storing alginate beads to maintain structural integrity. These findings contribute to advancements in enzyme immobilization techniques for industrial and biomedical applications.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P5

Estimation of Combustion Enthalpies using QM corrected Energetics

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UNCP

Bomb calorimetric combustion analysis of variants of phthalic anhydride performed in the lab produces results that conflict with current literature values. Using standard quantum mechanical computational methods, we seek to estimate the enthalpy of combustion for these compounds for comparison with the experimental calorimetric values. In this work, we investigate basis set convergence and validate the calculated enthalpy of combustion for several classes of organic compounds as a control dataset.

CBPSE-P6

Inhibiting the effects of thermal oxidation on hemagglutination

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Heating oleic acid – i.e. cis-9-octadecenoic acid aerobically, overnight at 1000C induces thermal oxidation of the component fatty acids. The thermally oxidized product is capable of inducing hemagglutination of mammalian red blood cells. It has been recently observed that hemagglutination can also be induced using oleic acid that has been heated to 1750C for 30 minutes in a microwave oven. For the latter process, the oleic acid titer – i.e. the smallest concentration capable of inducing hemagglutination, was 0.0063 milligrams per milliliter.

Hemagglutination is typically associated with: (1) abnormal morphology of red blood cells or (2) antibody-related response. Chemical induced hemagglutination far less common. Interestingly, oleic acid has also been implicated in the induction of acute respiratory distress syndrome (ARDS) through the production of reactive oxygen species (ROS) which damage lung tissue and contribute to inflammation. Thermal oxidation of oleic acid is also thought to yield reactive oxygen species which may contribute to the process of hemagglutination.

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The current research focus of this lab is an attempt to reverse the effects of hemagglutination by oleic acid via inhibition of thermal oxidation. Work has already begun to include antioxidants in the preparation of oleic acid for agglutination assays. As a fat-soluble antioxidant, Vitamin E – i.e. alpha tocopherol acts as a scavenger of lipid peroxyl radicals, within cell membranes and terminates the chain reaction of lipid peroxidation and protecting the membrane from oxidative damage i.e. hemagglutination. To inhibit oxidation and prevent hemagglutination, oleic acid samples will be heated in the presence of vitamin E.

While hydrophilic in nature, glutathione neutralizes reactive oxygen species by reducing peroxides and free radicals. Glutathione will be added to reaction buffer for the hemagglutination assay. In hopes of inhibiting oxidation and hemagglutination, both vitamin E and glutathione will be added in excess beyond their optimum plasma/cellular levels.

CBPSE-P7

Highly efficient bimetallic nickel-palladium nanoparticles supported on multi-walled carbon nanotubes for Suzuki cross-coupling reactions in continuous flow

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Suzuki cross-coupling reactions represent one of the most significant advancements in contemporary organic synthesis. These reactions are typically carried out under batch reaction conditions using a palladium catalyst in homogeneous form and other ligands and additives. However, the use of the catalyst under homogenous conditions has its limited viability mainly due to the high cost of the palladium metal and potential difficulty in removing the residual metal contamination from the reaction mixture. Continuous flow chemistry has been considered as an alternative approach to the traditional batch process by which the reagents can be passed through the solid based catalytic system while the product can be recovered continuously at the specific flow rate and residence time. We have recently prepared a bimetallic system consist of nickel and palladium nanoparticles deposited on the surface of carbon nanotubes (CNTs) using a mechanical shaking of the ball-mill.The method is straightforward and allows for the bulk preparation of the bimetallic catalyst at once suitable for applications in continuous flow chemistry.

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In addition, the concentration of the palladium metal in this mixture can be lowered to a minimum of 1%, a feature which can significantly contribute to the cost of the catalytic reactions. In this presentation, we discuss the remarkable catalytic activities of bimetallic nickel-palladium nanoparticles supported on multi-walled carbon nanotubes in Suzuki cross-coupling reactions of the functionalized aryl halides and phenylboronic acids in continuous flow. Given the short reaction time, incredibly low metal leaching, high yield of the product, and easy access to the large amount of catalyst, this approach is considered an affordable alternative for Suzuki cross-coupling reactions for large scale industrial applications in future.

CBPSE-P8

Optical properties of transitional metal dichalcogenides (TMDCs)

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Transition Metal Dichalcogenides (TMDCs) are two-dimensional structures that are made of one transition metal and two chalcogen atoms. These materials with a single to a few atomic layers exhibit unique electronic, optical, and mechanical properties making them suitable for application across different fields of science. In this project, we measured the absorption spectra of MoSe2, WSe2, TiSe2, and ZrSe2 using two different CCD spectrometers, one for UV-VIS and one for VIS-INR.

For MoSe2, we observed a peak at ~ 566 nm showing strong absorption at that specific wavelength. For WSe2, peaks were observed at ~ 432 nm and ~475 nm. For ZrSe2 and TiSe2, we observed broad absorption over the visible range.
Understanding these materials' absorption in the visible range will be helpful for exploring their potential applications in optoelectronic devices like photodetectors, solar cells, and light-emitting diodes (LEDs).

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P9

Structural Properties of Nb4C3Tx MXenes

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Nb-based MXenes, such as Nb4C3TX, exhibit high electrical conductivity, making them well-suited for energy storage and electronic applications. However, the greater stability of Nb-based MAX phases poses challenges in the etching and, consequently, is difficult to prepare as MXenes. Additionally, Nb-based MXenes are highly susceptible to oxidation, altering their fundamental properties. In this study, we focus on Nb4C3Tx MXenes, investigating their structural and thermal properties using (X-ray diffraction) XRD, (scanning electron microscopy) SEM, Raman spectroscopy, (Thermogravimetric analysis) TGA, and (Differential scanning calorimetry) DSC measurements. Thermal analysis plays a crucial role in determining materials' structural integrity and potential applications under high-temperature conditions.

XRD analysis confirmed the successful etching of aluminum, as evidenced by the disappearance of the characteristic aluminum peak, validating the preparation process. Raman spectra show significant peaks at ~300 and 677 cm-1 belonging to Nb-O and Nb-C respectively. TGA was utilized to measure thermal stability, oxidation analysis, and degradation behavior by monitoring the critical change in weight percentage. DSC measurements indicate no significant thermal events up to 300°C during heating and cooling cycles. Overall, this analysis aims to contribute to the information database of properties to extend the possible applications of Nb4C3TX. This comprehensive analysis provides valuable insights into the structural and thermal behavior of Nb4C3TX MXenes, contributing to the knowledge base necessary for their potential application in high-temperature and oxidation-sensitive environments. The findings aim to expand the scope of Nb-based MXenes for future technological advancements.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P10

Active zone heterogeneity at the mouse neuromuscular junction analyzed using 3D simulation programs

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Computational tools are extremely valuable in testing and understanding the molecular details of presynaptic mechanisms of neurotransmitter release. Monte-Carlo Cell (MCell) simulates molecular movements and reactions within and between cells to produce realistic 3-D cellular models of cellular microphysiology using experimentally derived properties (reaction & diffusion rates, spacing between proteins). This active zone (AZ) model extends the understanding of the interplay between voltage-gated calcium channels (VGCCs) and fusion-related proteins on docked synaptic vesicles.

By converting one computational model from MDL (Model Description Language) to Python (a more powerful and widely used language), I hoped to generate more powerful and realistic models with improved functionality. Soon, we will combine MCell (https://www.mcell.org) with a membrane potential simulator (NEURON), to precisely simulate electrical signaling details in nerve terminals. To make the result of each running seed experiment easier to understand and draw conclusions from, we will update the programs used to analyze and plot the results.

MCell's high-resolution, realistic models are more readily modified with a graphical interface, CellBlender, which streamlines the process of creating and improving computational models. It uses a simpler interface and produces realistic visualizations of activity. With the help of these simulators, we are trying to predict how Lambert-Eaton myasthenic syndrome (LEMS) can be affected by the absence of calcium ions.

I used Blender (https://www.blender.org/), CellBlender, MCell3, and MCell4 to rebuild the current known NMJ model to see where we should start making new changes based on recent superresolution microscopy data. Additionally, we will use our updated model to run experiments at the Pittsburgh Supercomputer Center to gather thousands of seeds of our model. Our data analysis will allow us to assess and improve our models, both control and diseased (LEMS) configurations.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P11

Leaf area predictions using several machine learning methods

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Accurate estimation of leaf area is crucial for understanding plant physiology and ecological dynamics. Traditional measurement methods can be labor-intensive and error-prone. This study applies machine learning (ML) models to predict leaf area based on leaf length, width, and plant height in 50 randomly selected Lamiaceae species. Four regression models—Linear Regression, Random Forest, Gradient Boosting, and Support Vector Regression—were evaluated using Root Mean Squared Error (RMSE) and Coefficient of Determination (R^2) scores. Results revealed significant variability in leaf morphology among the sampled species. Leaf length ranged from 1.2 cm to 20 cm (mean: 8.64 cm), while leaf width varied between 0.1 cm and 12 cm (mean: 4.59 cm).

Leaf area showed the greatest variability, spanning 0.31 cm^2 to 188.40 cm^2 (mean: 38.55 cm^2, SD: 39.30 cm^2). Correlation analysis identified leaf length ($r = 0.93$) and leaf width ($r = 0.93$) as the strongest predictors of leaf area, while plant height showed a weak correlation ($r < 0.15$), suggesting minimal predictive value. Among the ML models tested, Gradient Boosting ($R^2 = 0.98691$, Mean Absolute Error (MAE) = 2.45619) and Random Forest ($R^2 = 0.97719$, MAE = 3.37732) demonstrated the highest accuracy. In contrast, Support Vector Regression ($R^2 = -0.10107$) performed poorly, likely due to inadequate feature scaling. Feature importance analysis confirmed that leaf width and leaf length were the most influential variables, with plant height contributing minimally. These findings highlight the potential of machine learning for improving efficiency in botanical research, particularly in trait estimation and plant growth modeling.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P12

Characterization of Refractive index and Thermal coefficient via Michelson Interferometer

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The Michelson interferometer is a powerful optical instrument widely used for precise wavelength, refractive index, and thermal expansion measurements. Utilizing the principle of interference enables high-precision optical analysis, making it an essential tool in experimental physics. This study presents the determination of refractive index and characterization of thermal expansion coefficients of materials. By leveraging its high precision in measuring optical path differences, the interferometer successfully characterized the refractive index of Plexiglass materials within an 8% error margin. Additionally, the thermal expansion coefficients of aluminum were determined by observing the shifts in interference patterns due to temperature changes, providing valuable insights into the materials' behavior under thermal stress. The results demonstrate the versatility and accuracy of the Michelson interferometer in material characterization. Acknowledgment: This work is supported by the Pembroke Undergraduate Research and Creativity (PURC) Center at the University of North Carolina at Pembroke.

CBPSE-P13

Development and implementation of technologies for plastic recycling

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Plastic pollution is one of the most pressing environmental challenges today. Plastics are ubiquitous in modern products, appearing in clothing, packaging, and electronics, but recycling remains a significant hurdle, as most plastics are either not recycled at all or lose quality during the process. Methanolysis is a chemical recycling method that cleaves ester bonds in polymers to revert them into their monomeric forms; however, it traditionally requires high temperatures and/or pressures to effectively depolymerize polyesters In this study, we employ methanol and a potassium carbonate catalyst to simultaneously depolymerize multiple polyester plastics in a single solution under ambient conditions, while leaving non-target polymers unaffected. If successful, this approach could offer a single-step method for separating polyesters from mixed plastic waste while preserving the purity of the recovered monomers.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P14

Influence of pH on the Optical Properties of Nb_4C_3 Quantum Dot

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Fayetteville State University

In this study, Nb4C3 quantum dots (QDs) were synthesized via a hydrothermal method. The process involved adjusting the pH of Nb4C3 MXene and applying controlled heating to facilitate the formation of QDs. Atomic Force Microscopy (AFM) confirmed the nanometer-scale size of the QDs, verifying their successful synthesis. The optical properties were characterized using UV-Vis spectroscopy to measure absorbance and emission. Subsequently, the pH of the synthesized QDs was modified to different levels to assess the impact of pH on their emission properties. This analysis aims to determine how variations in pH influence the optical behavior of the QDs.

CBPSE-P15

Fabrication and characterization of lanthanide doped zirconium oxide materials for sensing applications

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Lanthanum zirconium oxide (LaZr2O7) has garnered significant attention due to its excellent photoluminescent properties for sensing applications. This work aims to enhance the materials' stability and photoluminescence efficiency by replacing the La3+ ion with Indium (In3+) and lanthanide ions (Er3+/Tb3+). A set of In2Zr2O7, (In, Er)2Zr2O7, and (In, Tb)2Zr2O7 were synthesized by dissolving the reactants at room temperature followed by a high temperature calcination step at 800 °C for three hours. The as-synthesized material was analyzed for its phase identification and phase purity using X-ray diffraction (XRD) equipment. The XRD data confirmed that three compounds were in their pure cubic crystal phase. Data from the energy dispersive x-ray spectroscopy confirmed the nominal elemental composition of the materials. The scanning electron microscope (SEM) was used to obtain magnified images of the synthesized materials. The SEM images recorded show the mixture of plate and sphere-type particles. The zirconates were further investigated for their photo- and cathodoluminescence properties. This research paves the way for the design, study, and understanding of the lanthanide ion-doped zirconate materials for sensing applications, an area previously unexplored.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P16

Determination of acetaminophen in urine using a rapid mass spectrometry technique

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Acetaminophen is an analgesic and antipyretic drug that is widely used as the active ingredient in various over-the-counter medications. Metabolic processing of acetaminophen is such that extensive liver damage can result when exceeding therapeutic dosages.

The availability of rapid point-of-care assays to quantify acetaminophen in body fluids is therefore essential for timely diagnosis and effective treatment of patients, and a significant research effort towards development of suitable technologies is on-going. Work in our lab aims to develop simple and rapid assays for drugs, toxins, and metabolites in various biological fluids for potential application in clinical settings. In this poster, progress towards the development of an assay for acetaminophen in urine using mass spectrometry is described. This assay entails use of atmospheric pressure chemical ionization and introduction of samples with an atmospheric pressure solid analysis probe (ASAP-APCI-MS). Comparison of neat and acetaminophen-spiked urine specimens indicates the mass spectral signals generated by the urine matrix do not interfere with the primary acetaminophen signals at m/z values of 152 amu and 110 amu.

Work in progress is exploring the feasibility of a standard addition approach to quantify urinary acetaminophen using a urine matrix component as an endogenous internal standard. Support of this research by the UNCP U-RISE Program, funded by the National Institutes of Health, is gratefully acknowledged.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P17

Microwave-assisted synthesis of Ti3C2 MXene

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MXenes have shown remarkable performance across various fields, establishing them as promising candidates for industrial applications. Consequently, high-yield production is essential to facilitate their commercialization and industrial use. However, conventional synthesis methods for MXenes are time-consuming and yield limited quantities. To overcome these limitations, microwave-assisted synthesis has emerged as an innovative solution, enabling the rapid and efficient production of MXene nanosheets. In this study, we focused on optimizing the synthesis parameters for Ti3C2 MXenes using the microwave-assisted synthesis method with the LiF/HCl route. Key parameters such as microwave power and reaction time were fine-tuned to achieve precise and reproducible results. We also examined how variations in microwave power and reaction time impact the structure of the MXenes. Structural analyses, including XRD, SEM, and Raman measurements, confirm that MXenes synthesized using optimized microwave-assisted parameters exhibit quality comparable to those produced through traditional methods. These findings highlight the potential of microwave-assisted LiF/HCl etching as a scalable, energy-efficient, and eco-friendly alternative for MXene preparation, which offers a pathway for integrating MXene materials into industrial and technological applications by overcoming limitations associated with conventional synthesis routes.

CBPSE-P18

In the search of new smells: synthesis of new esters using a new method

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The goal of this research is to develop a new method for developing fragrances in a laboratory setting. During this project, our aim is to develop more sustainable procedures using a reusable catalyst and green chemistry, rather than normal liquid acid/base as chemicals and easy to be potentially scaled up for larger production. We will be utilizing a variety of starting materials in order to synthesize new smell by the above-mentioned new method via reusable catalyst.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P19

Stability and electronic structure of (Ti,Ta)4C3 MXenes

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Using Vienna Ab initio Simulation Package called VASP, the first-principles calculations are performed to study the structural relationship of TixTa4-xC3 (with x = 0, 4) MXenes to their electronic and optical properties in the framework of Density Functional Theory (DFT). Electron–ion interactions are taken care employing the projector augmented wave (PAW) pseudopotentials and the generalized gradient approximation, parametrized by Perdew, Burke, and Ernzerhof (GGA-PBE) functional are used for the exchange–correlation in the system. All TixTa4-xC3 Mxenes are found metallic.

In single transition metal M4C3 Mxenes where M= Ti or Ta, the density of states are dominated by outermost d-states of respective M metal and 2p states of C. The domination of M-nd (n= 3 or Ti and 5 for Ta) over C-2p states is larger at Fermi level and conduction band. There is strong Ti-3d to Ta-5d hybridization in double transition metal TixTa4-xC3 MXenes, where x = 1 to 3. Ordered double transition metal MXene Ti2Ta2C3 is one of a desired MXenes for electrochemical application. Lithium discharge process is comparatively more favorable in Ti2Ta2C3 than other double and single transition metal TixTa4-xC3 MXenes.

POSTER PRESENTATIONS

ABSTRACTS

CBPSE-P20

A novel tool for dissecting the activation pathway of pro-apoptotic BAX.

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The delicate balance between cell survival and death is governed by the B-cell lymphoma 2 (BCL-2) family of proteins. The family includes pro-apoptotic proteins such as BAX and BAK, which promote cell death by creating pores in the outer mitochondrial membrane, and anti-apoptotic proteins like BCL-2, MCL-1, and BCL-XL, which promote cell survival by sequestering the pro-apoptotic proteins. The BH3-only proteins assist the pro-apoptotic proteins either by directly activating them or by inhibiting the anti-apoptotic proteins. One critical pathway involves the direct activation of BAX by a BH3-only protein, leading to BAX's translocation to the outer mitochondrial membrane and its self-assembly into multimeric pores. These pores facilitate the release of cytochrome c from the intermembrane space into the cytosol, triggering the caspase cascade that leads to cell death.

However, the dynamic nature of BAX multimers has complicated efforts to understand their self-assembly mechanism. In our study, we observed the conversion of BAX monomers (BAXm) into homogeneous oligomers (BAXO) upon exposure to the detergent fos-choline-12 (fos12). We found that BAXO functions similarly to tBID-activated BAXm, as evidenced by liposomal release and mitochondrial cytochrome c release assays. This creation of a homogeneous species of oligomeric BAX allows for a detailed characterization of the structural determinants of BAX self-assembly and membrane poration, providing significant insights into the mechanistic processes of apoptosis. Our findings contribute to a deeper understanding of cell death and survival, laying the groundwork for future research into the molecular intricacies of these critical cellular processes.

POSTER PRESENTATIONS

ABSTRACTS

CATEGORY: ECOLOGY, BOTANY, & ZOOLOGY

EBZ-P1

Ecological and morphometric analysis of venomous snakes in the United States

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Fayetteville State University

This study investigates the ecological and morphometric characteristics of venomous snakes in the United States, including six species from North Carolina, to elucidate relationships between body size, venom traits, and habitat distribution. We analyzed a dataset of 26 species, primarily from the Viperidae and Elapidae families, examining eight variables: total length, tail length, weight, venom yield, lethal dose (LD50), elevation range, geographic range, and population density. Data were compiled from herpetological surveys and ecological databases, spanning diverse U.S. ecoregions. Statistical methods, including correlation heatmaps, violin plots, and pairwise comparisons, were employed to explore trait interactions. Results reveal significant variation in morphometric and venom traits, with total length ranging from 53 to 213 cm (mean: 111.58 cm), venom yield from 3.1 to 800 mg (mean: 139.58 mg), and LD50 from 0.3 to 24.2 mg/kg (median: 3.1 mg/kg). Viperidae dominates species richness, particularly in the Southeast and Southwest U.S., reflecting habitat suitability. Correlation analysis shows strong positive relationships between body size (weight, total length) and venom yield ($r = 0.84, 0.65$), supporting the hypothesis that larger snakes produce more venom, though LD50 remains independent of size.

Population density inversely correlates with geographic range ($r = -0.35$), suggesting widely distributed species are less dense locally, while elevation range shows weak influence on morphology or venom. Distributions of traits like weight and venom yield are right-skewed, indicating a few exceptionally large venomous species. These findings enhance understanding of venom evolution and ecological adaptations, with implications for conservation and snakebite risk management. In North Carolina, species exhibit localized patterns tied to forested and wetland habitats, underscoring regional biodiversity. This study bridges gaps in integrative analyses of U.S. venomous snakes, offering a foundation for future research into environmental drivers of trait variation and human-snake conflict mitigation.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P2

Two invading ant species affect biodiversity in longleaf pine ecosystems

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University of North Carolina at Pembroke

Longleaf pine savannas are unique and diverse ecosystems, therefore establishment by invasive red Imported Fire Ants (RIFA, Solenopsis invicta) and Asian Needle Ants (ANA, Brachyponera chinensis) may have a significant impact on biodiversity. Our research goal is to survey invasive ant nests and ant diversity to identify changes in nest density, richness, and abundance over time. Surveys of RIFA nests were conducted along belt transects in 2014, 2017, and 2022 in three longleaf pine savannas. Pitfall traps were used to measure the abundance and richness of ants along the transects in 2017 and 2022. Our 2017 findings showed that RIFA was the most abundant ant species. In 2022 we resurveyed the same sites and our data revealed that 1) the ANA was now the most abundant ant species across sites, 2) RIFA abundance and nest densities decreased, 3) there was a sharp decrease in native ant abundance and richness, 4) soil texture impacted ANA and RIFA nest locations 5) and total ant abundance increased by 65% overall, but this was due to large increases in the ANA population. The ANA may be outcompeting other ants including RIFA, suggesting it may have a big impact on the community. These savannas are some of the most diverse in terms of fauna and flora in North Carolina, so it is paramount to understand the impact
of these invasive ants to mitigate any environmental effects of the species.

EBZ-P3

Optimization of a Greener Aqueous Wittig Reaction

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Campbell University

The Wittig reaction is one of the most effective chemical processes in organic chemistry to control regiochemistry in a new carbon-carbon double bond1. This reaction converts a carbonyl compound to an alkene using a triphenyl phosphonium ylide. A Wittig reaction using greener reaction conditions2 was introduced into the organic chemistry labs at Campbell University in 2018. The traditional reaction involves harsh and hazardous chemicals, but with the greener chemistry conditions this reaction is safer for undergraduate students3. However, the synthesis has resulted in very low yields and impure product in the hands of our students. This work focuses on improving purity and yields via optimization of reaction time, temperature, concentrations, other variables; including modifications in the workup. Recrystallization trials using different solvents have shown increased yields. Progress towards yield and purity improvements will be reported.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P4

Building Improved Synthetic Ethylene Reporters

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Department of Biological and Forensic Sciences, Fayetteville State University, Department of Plant and
Microbial Biology, North Carolina State University

Ethylene is a plant hormone that is important in many different stages of a plant's life. It has many different roles such as the regulation of fruit ripening and tissue senescence. Ethylene reporters, which consist of genes encoding fluorescent, luminescent, or enzymatic proteins attached to ethylene-controlled regulatory sequences, are an essential tool in plant research. These reporters can be used to help visualize the sites of ethylene production or ethylene response to an external stimulus. While existing ethylene reporters that make use of GFP (fluorescent protein) or GUS (an enzyme) provide good insight into a plant's response to ethylene, it remains difficult to normalize their expression in plants to control for copy-number and insertion-site variation between different transgenic lines. Dual luciferase assays can overcome this problem. This project leverages two different types of EBS (Ethylene Binding Site) promoters, EBSnew and EBS-S10, and two different luciferase reporters, Firefly luciferase and Nanoluc luciferase, combined using GoldenBraid cloning technology.

The project involves assembling the different DNA parts together, transforming the constructs into Agrobacterium, infiltrating the bacterial strains (with and without the ethylene precursor ACC) into Nicotiana benthamiana leaves, and quantifying the reporters using a luminometer. We hypothesize that Nanoluc driven by EBSnew will have the greatest amount of luminescent signal in response to ethylene treatment. The constructs labeled 3 and 4 were successfully assembled and are ready to be tested, while the constructs labeled 1 and 2 are still being assembled. The next steps for this project are to troubleshoot cloning steps for the remaining constructs and test the constructs through Nicotiana benthamiana leaf agroinfiltration and quantify the luciferase activity using a luminometer.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P5

Effects of Different Concentrations of Nano-Aluminum on Antioxidant Enzyme Activity of Cotton Seedlings

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Cotton (Gossypium hirsutum L.) plays an important role in many different aspects, such as the textile industry, industrial products, agriculture, and science. Finding effective growth techniques for cotton is crucial to maintaining high-quality production, providing a steady supply, and creating different resilient strains that can withstand disease, unfavorable climate conditions, and pests. This study observes the effects of different concentrations of nanoparticles on the roots and leaves of cotton plants. Our hypothesis is that lower concentrations of nanoparticles will promote plant growth while higher amounts of nanoparticles will inhibit growth. To test this hypothesis, cotton seedlings cultured in hydroponic boxes were treated with different amounts of nano-aluminum oxide (0, 50, 100 and 200 mg/L), and the biomass, malonaldehyde (MDA) content, soluble protein (SP), activity of superoxide dismutase (SOD), guaiacol-peroxidase (G-POD), and catalase (CAT) were determined. Results varied for each of the tests due to the different concentrations of nanoparticles.

As the concentration of aluminum oxide increased, the dry weight of the shoot and root were increased first and then decreased, and the highest values were obtained in plants treated with 100 mg/L nano-aluminum oxide. With the increase in the concentration of aluminum oxide, MDA content showed a decreased and then an increased trend both in leaves and roots. The SP content had an increased trend in the leaves and a decreased trend in roots. The activity of SOD and POD had an increased and decreased trend in the leaves and an increased trend in the roots; the CAT activity had an increased trend in the leaves and an increased and decreased in roots. In conclusion, suitable concentration of nano-aluminum oxide could promote the growth of cotton seedlings and enhance the activity of the antioxidant enzyme such as SOD, G-POD and CAT, and decrease the degree of membrane peroxidation.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P6

Exploring parasite prevalence within Ilyanassa obsoleta and seagrass ecosystems in bogue sound, back sound and the straits

Moore, A.A. Heaven*, Meghan Nadzam, Rachel Gittman, April Blakeslee
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This study investigates the ecological and morphometric characteristics of venomous snakes in the United States, including six species from North Carolina, to elucidate relationships between body size, venom traits, and habitat distribution. We analyzed a dataset of 26 species, primarily from the Viperidae and Elapidae families, examining eight variables: total length, tail length, weight, venom yield, lethal dose (LD50), elevation range, geographic range, and population density. Data were compiled from herpetological surveys and ecological databases, spanning diverse U.S. ecoregions. Statistical methods, including correlation heatmaps, violin plots, and pairwise comparisons, were employed to explore trait interactions. Results reveal significant variation in morphometric and venom traits, with total length ranging from 53 to 213 cm (mean: 111.58 cm), venom yield from 3.1 to 800 mg (mean: 139.58 mg), and LD50 from 0.3 to 24.2 mg/kg (median: 3.1 mg/kg). Viperidae dominates species richness, particularly in the Southeast and Southwest U.S., reflecting habitat suitability.

Correlation analysis shows strong positive relationships between body size (weight, total length) and venom yield ($r = 0.84, 0.65$), supporting the hypothesis that larger snakes produce more venom, though LD50 remains independent of size. Population density inversely correlates with geographic range ($r = -0.35$), suggesting widely distributed species are less dense locally, while elevation range shows weak influence on morphology or venom. Distributions of traits like weight and venom yield are right-skewed, indicating a few exceptionally large venomous species. These findings enhance understanding of venom evolution and ecological adaptations, with implications for conservation and snakebite risk management.

In North Carolina, species exhibit localized patterns tied to forested and wetland habitats, underscoring regional biodiversity. This study bridges gaps in integrative analyses of U.S. venomous snakes, offering a foundation for future research into environmental drivers of trait variation and human-snake conflict mitigation.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P7

Is the fox afraid of a tiger? Examining responses of meso-predators to native and exotic scents

Price, Junior*, Jacobson, Andrew
Catawba College

Due to the loss of apex predators in North America, such as wolves Canis lupus, there is an abundance of meso-predators. The increased population of meso-predators, such as coyotes Canis latrans, can have negative impacts on other carnivores, domestic animals and native prey. This impact is called a trophic cascade and has been widely documented. For instance, the lack of wolves in many parts of North America has freed coyotes from interference competition, allowing their numbers to increase and thereby limiting the abundance of red foxes Vulpes vulpes.

Due to the intraguild killing and competition they experience from wolves, coyotes alter their behavior when exposed to scents of wolves. Since animal communication occurs through scents and vocalizations, information can be gathered by individuals of different species (inter-specific) or the same species (intra-specific). Therefore, it has been suggested that humans may be able to manipulate the behavior of meso-predators, for instance, through the use of artificial or fake animal communication ‘messages’ from apex carnivores.

Perhaps certain carnivore scents can be used to fool or trick a meso-predator into believing that an apex predator is present and thereby change the meso-predator's behavior, such as leaving an area where the fake scent has been applied. If successful, this type of artificial animal communication could minimize negative impacts from inflated meso-predator densities. In this project, we will explore how interspecific scent communication within the carnivore guild may change the behavior of meso-predators by observing their reactions on camera traps to a variety of introduced scents. We believe an increase in investigating behaviors and decrease in activity in the area will occur when exposed to scat of varies species across all trophic levels.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P8

Conducting mosquito surveillance near the agricultural research site (ACRES) in Pembroke, NC

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University of North Carolina at Pembroke, University of North Carolina at Chapel Hill

Mosquito surveillance, including identifying species and their circulating arboviruses by location, is crucial in protecting public health. When high numbers of arbovirus-carrying mosquitoes are present, strategies to eliminate them can be implemented. Although surveillance is conducted throughout North America, some areas are overlooked due to a lack of funding and expertise. Robeson County hasn't conducted surveillance, despite evidence of arboviral outbreaks in North Carolina. According to the North Carolina Department of Health and Human Services (NCDHHS), the main arboviruses transmitted in North Carolina are La Crosse encephalitis, West Nile virus, and Eastern equine encephalitis. La Crosse encephalitis is carried by Aedes triseriatus, West Nile virus is carried by Culex species, and Eastern equine encephalitis is carried by Culiseta melanura. These arboviruses cause encephalitis, which can lead to serious effects like comas. Additionally, no vaccine is available for these diseases; therefore, patients receive supportive care only.

We hypothesized that Aedes and Culex species would be abundant but no viruses would be detected. This is because these mosquitoes are likely found in areas like ACRES, and the chance of a mosquito being infected is roughly 1:2000. The ACRES research site is densely populated with plants and lacks human activity. A gravid trap baited with carbon dioxide and fish fertilizer emulsion and a CDC-blacklight trap baited with carbon dioxide alone were set up at the site. Upon collecting the traps, mosquitoes were speciated and homogenized.

Using the MagMAX isolation kit, nucleic acid was extracted and then qRT-PCR was conducted to test for viruses. We found an abundance of Aedes and Culex species, with many Coquillettidia perturbans mosquitoes, which are vectors of West Nile virus and Eastern equine encephalitis. These preliminary results support our hypothesis, but further mosquito surveillance will be conducted to better characterize mosquitoes and circulating arboviruses.

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ABSTRACTS

EBZ-P9

Ecological and Morphometric Analysis of Venomous Snakes in the United States

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Fayetteville State University

This study investigates the ecological and morphometric characteristics of venomous snakes in the United States, including six species from North Carolina, to elucidate relationships between body size, venom traits, and habitat distribution. We analyzed a dataset of 26 species, primarily from the Viperidae and Elapidae families, examining eight variables: total length, tail length, weight, venom yield, lethal dose (LD50), elevation range, geographic range, and population density. Data were compiled from herpetological surveys and ecological databases, spanning diverse U.S. ecoregions. Statistical methods, including correlation heatmaps, violin plots, and pairwise comparisons, were employed to explore trait interactions. Results reveal significant variation in morphometric and venom traits, with total length ranging from 53 to 213 cm (mean: 111.58 cm), venom yield from 3.1 to 800 mg (mean: 139.58 mg), and LD50 from 0.3 to 24.2 mg/kg (median: 3.1 mg/kg). Viperidae dominates species richness, particularly in the Southeast and Southwest U.S., reflecting habitat suitability. Correlation analysis shows strong positive relationships between body size (weight, total length) and venom yield ($r = 0.84, 0.65$), supporting the hypothesis that larger snakes produce more venom, though LD50 remains independent of size. Population density inversely correlates with geographic range ($r = -0.35$), suggesting widely distributed species are less dense locally, while elevation range shows weak influence on morphology or venom. Distributions of traits like weight and venom yield are right-skewed, indicating a few exceptionally large venomous species.

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ABSTRACTS

EBZ-P10

Urban Stream Health Assessment Study Project in Guilford College

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Urban Stream Syndrome (USS) represents a significant ecological challenge in developed areas, characterized by the degradation of stream ecosystems due to urbanization. The ecosystems that are becoming affected by the increase in impervious surface still remain critical ecological corridors within our cities as they are crucial to the health of our ecosystem and to be able to support the lives of macroinvertebrates, the ecosystem is also crucial to the lives of humans that inhabit the area. There are a number of complex interactions between urbanization intensity and stream ecosystem health across a gradient of urban development. Throughout this thesis we investigate previously acquired data from a lab performed within Introduction to Biology: Ecology and Evolution.

We analyzed data collected from streams at Guilford College and two branches of Buffalo Creek within Greensboro, North Carolina. Focusing on key parameters including pH, temperature, dissolved oxygen, turbidity, and flow rate. Our comparative analysis reveals significant variations in macroinvertebrate diversity and water quality metrics corresponding to different levels of urban impact. By examining these parameters over time, this study aims to determine whether the stream health at Guilford College is improving or degrading, and to identify potential causative agents of any observed degradation.

Additionally, we evaluate Course-Based Undergraduate Research Experiences (CUREs) to enhance both student engagement with ecological research and improve the quality and accuracy of our stream assessment methodologies.

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ABSTRACTS

EBZ-P11

The Ecological Impact of Invasive and Native Species on Ground-Nesting Birds

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Guilford College, Boulder County Parks and Open Space

The foothills of Colorado are covered in invasive species of cheatgrass (Bromus tectorum). This study investigates the impact on ground nesting bird populations in that of invasive species vegetation and native vegetation in Boulder County Colorado. Ground-nesting birds are critical to ecosystem health and biodiversity, yet their habitats are increasingly threatened by invasive plant species.

We conducted field surveys and counts across multiple sites, comparing bird presence and nesting success and counted and quantified the amount of rare and invasive species. Results indicate a significant differential, with ground-nesting birds being observed more frequently and successfully in native and rare species habitats. Specifically, abundance of nests and key bird species in areas that are already struggling in cheatgrass-dominated areas.

Our findings suggest that the structural and compositional differences between these vegetation types create unfavorable conditions for ground-nesting birds in cheatgrass-invaded landscapes. This research implicates cheatgrass as a problem and the need for conservation efforts focused on habitat restoration not only to support ground-nesting bird populations but also enhance ecosystem resilience and restoration to native lands.

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ABSTRACTS

EBZ-P12

Multi-locus GAWS mapping Kudzu bug resistance in soybean (Glycine max L. Merr.)

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Soybean (Glycine max [L.] Merr.) is a crucial crop in the United States due to its high economic value, primarily attributed to its rich protein and oil content, making it a vital source of nutrition for both human consumption and animal feed. However, soybean plants suffer significant damage from insect pests, leading to substantial yield losses. To investigate genetic resistance to kudzu bugs, a multi-locus genome-wide association study (Multi-Locus GWAS) was conducted using a mapping panel of 169 soybean accessions. Our study identified 17 quantitative trait nucleotides (QTNs) significantly associated with insect resistance, distributed across 13 chromosomes. These QTNs explained various degrees of phenotypic variation (0.7-34%), as determined using the R package mrMLM (v4.0). Significant QTNs on chromosomes 4, 10, 11, 12, 14, and 20 were consistently identified by multiple models using two years of assessment data. Notably, On chromosome 4, three QTNs associated with kudzu bug resistance were identified using multiple models, including mrMLM (2), FASTmrMLM (2), ISIS EM-BLASSO (2), pLARmEB (2), and FASTmrEMMA (1). These QTNs explained phenotypic variation up to 17.63% across both years using the multi-locus GWAS approach.

Additionally, on chromosome 12 (H), a significant QTN, ss715612709, was associated with resistance and explained the phenotypic variation up to 33% in 2023 across three models. This QTN is co-located with a previously identified quantitative trait locus (QTL) anchored by SSR markers Sat_118, Satt442, Sat_175, and Satt334. Similarly, another significant QTN, ss715632177, identified on chromosome 18 (G), was associated with kudzu bug resistance and shared the same genomic interval as a QTL reported in a previous study, flanked by SSR markers Satt472 and Satt191. In summary, our study provides valuable insights into the genetic basis of soybean resistance to kudzu bugs. The identified QTNs will be used to develop new soybean varieties with improved pest resistance and enhanced yield potential.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P13

Species diversity of honey bee (Apis mellifera) pollen at the UNCP Apiary

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UNC Pembroke

Honey bees (Apis mellifera) play a significant part in the pollination services of agriculture and their local environment, acting as effective pollinators of our food crops and wild plants. Bees perform the majority of pollination for our cultivated crops, with bee-pollinated crops contributing to one-third of the human dietary supply. The University of North Carolina at Pembroke (UNCP) Garden was created in 2014, and an apiary was later created for educational purposes. Honey bee pollen has been collected from the UNCP Apiary for several years. We will extract the DNA from pollen samples using a commercial kit with the hopes of discovering their botanical origin by sequencing the gene of interest, rbcL, which encodes for the large subunit of ribulose bisphosphate carboxylase, an enzyme that is in the chloroplast. Preliminary data from the Plant Systematics students of Spring 2024 found that pollen collected in the late winter was composed of Camellia sinensis, Taraxacum officinale, Prunus virginiana, P. persica, and Rubus trivialis, which is consistent with late winter flowering plants. In the continuation of this project, we will expand our study to include identifying and comparing the species richness in the pollen at two UNCP apiary sites, determining the honey bee's preferred plant species, and creating a pollen color chart for the apiary. With this research, we can provide insight into honey bee interactions with pollination gardens and their plant preferences.

EBZ-P14

Understanding how monoculture vs. companion planting differentiates in the amount of yield portions

Ward-Swan, Stacious*, Sydney Duffy, Caroline Beuscher, Sydney Ballard, Tate Peterson, Ty Cryan, Victoria Ochieng, Carius McClain, Susana Wadgymar
Davidson College, Fayetteville State University

Companion planting is an ancient agricultural practice that has been conducted for generations. It involves strategically placing two or more types of plants in a single bed to maximize the beneficial interactions between them. One of the most notable examples of companion planting is the Native American technique known as The Three Sisters, where native corn, beans, and squash are grown together.

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In this method, each plant contributes to the growth of the others; the corn provides natural support for the beans, the beans fix nitrogen in the soil, and the squash offers ground cover to reduce weeds and maintain moisture. This project was initiated using a recently discovered collection of Catawba Corn, gathered during a period of early colonization. The primary objective of this study is to gather valuable data that will enhance crop production techniques for the Catawba tribe in the future, while also discovering optimal methods for crop growth. Our hypothesis suggests that crops grown in direct contact with the bean-planted soil will exhibit higher yield growth. This is attributed to the nitrogen released by beans into the soil, which acts as a natural stimulant for adjacent crop growth.

To test this hypothesis, we established five beds of monoculture beans, five beds of Catawba corn, and five beds of companion corn with beans. In the companion beds, the Catawba corn was arranged in a 6x6 square pattern, while the skunk beans were positioned diagonally at each individual corner of the corn plants in an 8x8 inch square pattern. Data on plant height, stem diameter, and overall growth were carefully recorded. The preliminary results provide enough evidence to suggest that companion planting may increase crop yield compared to monoculture planting. Further monitoring of both companion and monoculture plots will continue until the crops reach mature growth.

EBZ-P15

Oxidative stress in zebrafish brain (Danio rerio)

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Social aggression across species, including humans, often results in social stress and changes in group organization. This study explored how social dominance affects the structural and functional organization of the hypothalamic A11 dopaminergic nucleus in zebrafish. The A11 nucleus integrates sensory information to modulate startle escape and swim circuits. Once dominance is established, subordinates exhibit heightened sensitivity in their escape response and reduced swimming activity, while dominants show the opposite behavior.

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Dominants also have more A11 neurons than subordinates, with a negative correlation between status and synaptic connections. The study aimed to explore the decline in A11 neurons by assessing the expression of superoxide dismutase (SOD1), an enzyme protecting against oxidative stress and a marker for early apoptosis. Researchers hypothesized that variations in the A11 nucleus could partially mediate these behavioral differences. We dissected and stained communal female zebrafish brains using immunostaining and imaged them with a confocal microscope. Preliminary findings showed that SOD1 staining helped visualize the A11 nucleus's structural organization and its response to oxidative stress. The study concluded that zebrafish form stable dominant relationships, which correlate with morphological differences in the A11 nucleus. Future research will focus on comparing dopaminergic cells in dominant and subordinate zebrafish to further understand how social experiences shape the nervous system and influence behavior.

EBZ-P16

Post-predation parental behavior of northern mockingbirds

Devon Burrell*, Christine Stracey
Guilford College

Thanatology is an interdisciplinary field that classically studies death and dying behaviors in humans. However, this field of study can also be applied to animals. How does the death of a conspecific affect the behaviors of an individual? Do their behaviors change based on the relationship to a conspecific? Very little is known about the post-predation behaviors of parent birds, with most thanatology studies being conducted on apes, cetaceas, and proboscids. Nest predation is a significant contributor to failed nests of Northern Mockingbirds (Mimus polyglottos), however, post-predation behaviors have not been documented. We are observing video footage of 31 mockingbird nests to document post-predation behaviors of parent birds. We are 1) quantifying the time to nest abandonment after a predation event based on nest stage (egg vs nestling) and the age of the nestling(s), and 2) documenting the following behaviors exhibited by parent birds following a predation event; food being brought back to the nest, cleaning of the nest, brooding behaviors, and vocalization upon returning to the nest. Our preliminary results indicate that there is a negative correlation, as nestling age increases, the time till abandonment decreases. We have also found many instances of all of the behaviors previously listed throughout the observed nests. Ultimately, we hope to begin to understand how non-human animals perceive and interpret death. To accomplish this, we must first document the behaviors surrounding death. Future research can build on these results to begin to identify the possible behavioral and cognitive reasons behind the behaviors exhibited by non-human animals surrounding death.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P17

Beyond the typical weather forecast: Harnessing probabilistic graphics for effective emergency management

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Severe weather is challenging to predict but even more so to prepare for. County Emergency Managers (EMs) and other local officials are tasked with the dilemma regularly of being fiscally prudent yet always prepared. Tabletop exercises were conducted in northern California to better understand whether two experimental graphics could better support the difficult decisions being made. First, background interviews were conducted with EMs in two counties before the exercises to better understand local concerns and their decision-making process. All interactions with participants were recorded and transcribed by a professional transcription company. Special attention was given during the analysis regarding the two probabilistic graphics: a box-and-whisker graph and a stacked bar graph.

They contained similar information but displayed it in different ways. Because the tabletop exercises had many participants, an anonymous online survey about the two graphics helped ensure everyone could provide their input. Surveys and tabletop discussions were analyzed to better understand how EMs and other local officials use weather forecasts. In particular, how understandable the probabilistic graphics were and whether they would be used prior to a potential flooding event. The results show that both graphs are helpful in the decision-making process. Still, timing and adequate meteorologists' input would need to be provided to EMs and other local officials to optimize their usability.

POSTER PRESENTATIONS

ABSTRACTS

EBZ-P18

Analyzing and Comparing the Volume of Microplastics in the Lumber River Upstream and Downstream of Lumberton

Ivey, Hunter*, Dr. Sean Hitchman
University of North Carolina at Pembroke

As plastic waste breaks down, the microplastics produced inadvertently end up in our waterways, which has led to microplastics being present in nearly every aquatic ecosystem around the world. Through biomagnification, these microplastics build up in the bodies of organisms over time, ultimately ending up in humans. The environmental and health risks of microplastics have been widely recognized, and legislation on both the national and international levels have been issued in order to help slow the effects of microplastics in aquatic ecosystems. We believe that the majority of the microplastics in the Lumber River can be traced back to the large towns and cities that sit on its watershed. Specifically, we believe that the abundance of microplastics will be much higher downstream from the city of Lumberton as compared to the abundance of microplastics upstream from the city. By filtering water collected from both upstream and downstream of the city of Lumberton, staining the filter paper, and analyzing the dyed microplastics, we were able to create a summary of the distribution and abundance of microplastics in the Lumber river. This study will serve as a pilot study for further research into how the microplastics in the Lumber river behave in regard to the soil, flora, and fauna.

EBZ-P19

Exploring and mapping water quality in the Lumber River watershed

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University of North Carolina at Pembroke

The Lumber River is a culturally, ecologically, and economically important river in Southeastern North Carolina. The Lumber River and its tributary wetlands form a unique, free-flowing blackwater system that supports a high biodiversity of plants and animals. However, the Lumber River watershed has, for decades, been home to a high number of polluting industries, including both manufacturing and agricultural applications. These industries represent both historical pollution discharges and

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current threats to water quality in this regionally important watershed. Ensuring the water quality of this watershed is imperative to ensuring the good health of the ecosystem and its inhabitants. This study evaluates water quality data collected over the past year and compiles several research and service-learning projects into an ArcGIS map that projects the results alongside land use and topographical data. These projects investigated biological, physical, and chemical metrics of water quality, including fecal coliform bacteria, benthic macroinvertebrate community composition, nitrogen and phosphorus concentrations, and standard physical variables such as dissolved oxygen, pH, and turbidity. Data collected thus far suggest few impacts of agricultural runoff, as nitrogen and phosphorus concentrations were typically low. However, the data suggest marginal impacts of runoff from urban areas, including increased conductivity downstream of the city of Lumberton. The strongest impacts have been associated with industrial runoff, with increased heavy metals and decreased macroinvertebrate biodiversity downstream of historical and current industrial sites. Based on these findings, it is apparent that future research in this watershed should include a more rigorous evaluation of water quality. A more systematic approach could better capture the full complexity and dynamic nature of pollution impacts in this region.

EBZ-P20

Comparative analysis of ecosystem metabolism between two small ponds with differing hydrology

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University of North Carolina at Pembroke

A major driving factor for Earth's changing climate is human impacts on the carbon cycle, specifically on how much carbon dioxide is released into the atmosphere. Freshwater ecosystems can play a significant role in the carbon cycle and can be either a net source or net sink of carbon relative to the atmosphere. In addition, previous research suggests that smaller ponds may be important contributors to the global carbon cycle relative to their size, possibly due to their rich abundance of primary producers. Southeastern North Carolina is known for its wetlands and unique blackwater ecosystems, which are relatively understudied, as well as its vulnerability to hurricanes. The anticipated changes in weather due to climate change, such as increased fluctuations in precipitation, may lead to major shifts in carbon cycling due to possible extreme flooding or drought.

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Therefore, it is important to better understandecosystem metabolism and carbon cycling within our local ecosystems. A comparison of carbon cycling between a constructed retention pond (data collected in 2021) and a naturally occurring wetland pond (data collected in 2025) will provide more information regarding the impacts of small ponds on carbon cycling and climate change. We collected dissolved oxygen and temperature readings at 15-minute intervals via a deployed PME miniDOT Logger. We then obtained weather data from the weather station closest to each pond. We used the LakeMetabolizer and RLakeAnalyzer packages in R to align the data and calculate ecosystem metabolism. Data collected in 2021 indicated that the campus pond fluctuates between a net source and a net sink of carbon to the atmosphere, and our study will determine whether a naturally occurring wetland pond follows similar trends.

EBZ-P21

Maximizing nutrient removal in wastewater treatment: biochar system assessment for enhanced nitrogen reduction

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Even when treated to meet state permit limits, the discharge of substantial volumes of domestic and industrial wastewater increases reactive nitrogen concentrations in aquatic environments, resulting in ecological stress and biodiversity depletion. More effective nitrogen removal from wastewater effluent is crucial to mitigate these problems, necessitating cost-effective and practical treatment methods. Biochar, a high-carbon charcoal-like product with a large surface area, abundant functional groups, and porous structure, shows potential to effectively adsorb nitrogen in wastewater and can be recycled into fertilizer for soil amendment. The objective of our study was to evaluate the efficacy of hydrogen peroxide (H_2O_2)-doped biochar in adsorbing ammonium (NH_4^+), a significant inorganic form of nitrogen present in wastewater. To enhance the adsorption capacity of biochar through hydrogen peroxide modification, multiple batches of varying concentrations of hydrogen peroxide-doped biochar were tested to identify the optimal formulation for efficient removal of NH_4^+ from wastewater within a specific timeframe. We hypothesize that doped biochar will effectively capture excess nitrogen from wastewater. Once the optimal batch is identified, column experiments will be conducted to evaluate its performance under flow-through conditions. Our findings will provide additional support for a novel, low-cost technique that could be implemented in existing wastewater treatment systems to enhance nitrogen removal. Future work could focus on optimizing biochar-based technologies for broader applications in environmental remediation.

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EBZ-P22

Impact of regenerative agriculture on colony-forming units (CFU) and antibiotic-producing bacteria

Bohlen, Samuel*, Dr. Michelle Suhan Thomas
Campbell University

Regenerative agriculture is an increasingly popular method of farming that recovers the ecosystem and has been linked to increased soil quality. Soil microbes are a key component of the soil health ecosystem. This study will be exploring links between farming practices and soil microbial counts as well as antibiotic producing isolates. Soil samples at a depth of 4” and 12” were collected from four farms with varying practices. Colony- forming units were counted following serial dilution and spread plating. There was a notable 85% increase in average CFU counts between the conventional farm and seasoned regenerative sites. Colonies were selected from spread plates and screened for antibiotic production against near-relatives of ESKAPE pathogens. Regenerative agriculture practices resulted in a 50% increase in antibiotic producing isolates, with seven gram negative and two gram positive bacilli or coccobacilli shown between all sample locations. There was shown to be a positive correlation between regenerative agriculture and both soil microbial counts and antibiotic-producing isolates. This reinforces the common belief that regenerative agriculture has holistic benefits to the ecosystem.

EBZ-P23

Maybe it Should be Sugarcoated: Xylitol’s Inhibitory affects against Streptococcus mutans.

Ruiz-Marin, Vanessa*, Camacho, Francisco
Catawba College

The human oral microbiome is a complex ecosystem crucial for our systemic health, with Streptococcus mutans being an important contributor to dental caries. Xylitol, a natural sugar alcohol, is recognized for its benefits in oral health including the reduction of plaque and bacterial growth.

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This study hypothesizes that the addition of xylitol will significantly reduce the growth of streptococcus mutans, thereby demonstrating its potential as an effective agent in inhibiting the growth of this bacteria. An IRB was submitted to obtain permission to conduct a small-scale clinical trial among a group of college students at Catawba College. The trial was conducted using saliva as our sample medium, the samples were analyzed using a qPCR method and compared using a t-test and a paired t-test to compare the quantity of bacteria found initially in the oral microbiota when using a product with a small concentration of xylitol and compared to a group who received a sugar-based gum and a group who was not introduced to any gum. The group that was treated with a xylitol-based gum resulted in a smaller concentration of Streptococcus mutans bacteria whereas the group treated with a sugar-based gum showed an increase in quantity of the S. mutans bacteria. The consumption of the xylitol-based gum most likely resulted in the decrease of quantity of the S. mutans bacteria without changing the overall oral microbiome. The knowledge earned from this research will be used to inform a larger population of the importance of oral health and how they can obtain a healthier oral microbiome, with less frequency of caries by changing a small detail in their daily dietary habits.

EBZ-P24

Real-life Zombies: Cordyceps in our Backyard?

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Catawba College

With a horror story that pushes the boundaries of nonfiction, Ophiocordyceps, a genus of parasitic fungi, infamously turns ants into ‘zombies’, manipulating the host's behavior to favor parasite survival and reproduction over host viability. Such behavior in Ophiocordyceps unilateralis is exhibited through phenotypic attributes displayed by Camponotus spp. hosts, such as a “death grip” induced by chemical manipulation of the host to the underside of a twig. Recently, Camponotus spp. ants have been observed in Catawba College’s Fred Stanback Jr. Ecological Preserve (FSJEP) with demonstrated infection by suspected Ophiocordyceps. We hypothesized that the fungus infecting ants in our preserve is related to O. unilateralis kimflemingae, a newly described parasitic species from neighboring South Carolina. We used a three-pronged approach to characterize this new FSJEP fungal parasite, through morphological, behavioral, and molecular attributes. Morphologically, the FSJEP species is similar in size and lifecycle forms to O. u. kimflemingae, as determined through light microscopy.

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CATEGORY: MICROBIOLOGY

MICRO-P1

Comparative Analysis of Histone Mark Distribution in HepG2 cells in Response to HBV Infection and HCC Development

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Elon University

This research aims to identify and compare histone modification patterns in hepatocellular carcinoma (HCC) and Hepatitis B Virus (HBV)-infected cells. HBV is a small DNA virus that infects the liver, affecting over 296 million people worldwide. Chronic HBV infection is the leading cause of HCC, a form of liver cancer responsible for 70-85% of all liver cancer cases globally. HBV's replication relies on episomal covalently closed circular DNA (cccDNA), which serves as a template for viral mRNA transcription. Among HBV's viral proteins, Hbx is a critical regulator that alters the epigenetic landscape of host cells, particularly by modifying histones – proteins essential for DNA organization and gene regulation.

Histone modifications, such as trimethylation (H3K27me3) and acetylation (H3K27ac) at lysine residue 27 on histone H3, play key roles in regulating gene expression by repressing or activating specific loci. This study will compare these histone modification patterns in HCC and HBV-infected cells with those in normal liver cells to identify loci associated with altered gene activity. Results are expected to reveal increased H3K27ac at oncogenic loci and increased H3K27me3 at tumor suppressor loci. These findings aim to enhance the understanding of HBV-induced epigenetic dysregulation and may inform the development of more targeted therapeutic strategies for HCC.

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MICRO-P2

Low magnetic field strength 19F NMR of breast and formula milk and examination of potential anti-microbial activity

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Methodist University

The safety and quality of infant nutrition is of utmost importance, as it determines the well-being of future generations. There is much debate on whether maternal milk or commercial formula is more advantageous to infants. Providing scientific insights on infant nutrition could empower parents to make informed decisions and possibly improve the manufacture of baby formula.

Multiple chemical analysis and biological assays will be applied to make comparisons. The response of two breast milk donors (B1and B2) and a formula brand for infants will be measured under a low magnetic field strength 80MHz (1.8T) NMR to assess difference in proton and fluorine resonance signals. 1-D proton and 1-D fluorine NMR will be collected on samples treated with 2M acetic acid to facilitate precipitation of proteinaceous components of extraneous milk solids; the resultant filtrate from gravity filtration will then be collected and run on a SpinSolve 80MHz tabletop NMR spectrometer for a minimum of 4000 scans. Difference spectra and broad NMR linewidths will be compared to ascertain differences in proton and fluorine environments from two donor samples and one store-brought commercial product. The NMR spectra detecting both fluorine and proton signals can provide valuable insight into chemical differences between individual breast milk donors versus those industrially manufactured.

Furthermore, the B1, B2, and Similac samples will be assessed for antimicrobial properties against water as a control. Antimicrobial action will be determined by whether the samples inhibit the growth of six different common gastrointestinal (GI) pathogens.

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MICRO-P3

Comparing the 3D chromatin organization of 2 breast cancer subtypes through Hi-C analysis

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With breast cancer affecting a large portion of the population, finding effective methods of treatment is an increasingly strong demand. Cancer is a result of incorrect gene expression resulting from abnormal 3D chromatin organization. Through breast cancer research, specific targets have been identified to strengthen prognosis and efficacy of treatment. This project aims to find differences between breast cancer subtypes to aid in identification of specific genetic structures and expression for cancer treatments. Through Hi-C analysis, comparisons can be made between the different subtypes to find unique features of genome organization in each subtype.

Hi-C is an experiment that identifies interactions between regions of DNA, allowing us to analyze 3D structures and chromatin organization. This data can be used to make contact maps that show where the chromatin interactions are occurring. This can show unique structural elements in the subtypes such as TADs and chromatin loops. This research will identify and explore how the chromatin interactions are similar and different in 2 breast cancer subtypes (ER-positive and TNBC). Contact heat maps will be used to visualize contactfrequency from Hi-C datasets and find chromatin loops and interactions. Then, combining this data with RNA-seq data, we can see the expression of genes and what the structure looks like at those areas. Both breast cancer subtypes will be compared against each other to find similarities and differences.

The expected results will suggest that TNBC has the most variability compared to normal-like cells. Based on previous results in the lab, we expect that 3D organization of ER+ and TNBC samples will be the most different, contributing to the vast differences in gene expression profiles. Investigating breast cancer subtypes will provide insights for more effective precision medicine therapies for breast cancer patients.

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MICRO-P4

Investigating the Effects of Environmental Changes on Capsule Production and Antibiotic Susceptibility in Lactobacillus acidophilus

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Lactobacillus acidophilus, a gram-positive rod-shaped bacterium in the Lactobacillus genus, is essential for preserving vaginal health. It flourishes in microaerophilic settings with temperatures ranging from 35-38°C and a pH between 5.5 and 6.0. A significant characteristic is the formation of a polysaccharide capsule that serves as a protective shield against environmental stressors and antimicrobial substances. Although it is significant, the processes controlling capsule biosynthesis and its effect on antibiotic susceptibility are still not well understood. Variations in the environment, like shifts in pH and temperature, can greatly affect the survival and performance of L. acidophilus. Alterations in the vaginal microbiome, affected by elements such as antibiotic consumption, hormonal changes, or infections, can change the microbiota from a Lactobacillus-dominant condition to a polymicrobial profile, heightening the risk of bacterial vaginosis (BV) and various vaginal infections. Comprehending the effects of environmental stressors on L. acidophilus is crucial for enhancing probiotic uses and strategies for vaginal health. This research explores the impact of environmental elements on capsule formation and antibiotic resistance in L. acidophilus. By adjusting pH and temperature to replicate vaginal conditions, we will evaluate bacterial growth, capsule development, and antibiotic resistance.

Optical density readings will be utilized to track growth, whereas capsule staining and antibiotic susceptibility tests will offer information on bacterial adaptation in various environments. Our results demonstrated that L. acidophilus was able to produce capsule and demonstrated antibiotic resistance; however, we did not observe a change in these factors based on temperature and pH. Further studies are needed to understand how L. acidophilus responds to and influences these factors. Ultimately, our goal is to assess whether probiotic treatments can be designed to restore and maintain a healthy vaginal microbiome, support strategies for preventing bacterial vaginosis, and improve gynecological health outcomes.

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ABSTRACTS

MICRO-P5

Genomic diversity and public health impact of foodborne bacteria: A comparative analysis

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Fayetteville State University

Foodborne bacterial pathogens are a major global health threat, causing millions of illnesses and deaths annually. The advent of microbial genomics has provided unprecedented insights into their genome architecture, virulence, and antimicrobial resistance (AMR) mechanisms. However, the relationship between genomic features and public health outcomes remains poorly understood. In this study, we analyzed the genomes of 50 foodborne bacterial species, examining their genome size, gene number, GC content, virulence factors, and AMR genes, alongside epidemiological metrics such as annual global cases and mortality rates. Our results reveal substantial genomic heterogeneity, with weak correlations between genome complexity and mortality, indicating that pathogenic severity is influenced by factors beyond genetic content alone. Some bacteria possess extensive virulence and AMR genes yet exhibit relatively low mortality, whereas others with smaller genomes cause high fatality rates. These findings underscore the need for an integrated approach that combines genomic data with epidemiological surveillance to enhance foodborne disease risk assessment and control strategies.

MICRO-P6

Predicting mortality rates of foodborne bacteria using machine learning: A comparative study of regression models

Bradford, DreShawn*, Kassem, Abdelmajid
Fayetteville State University

Foodborne bacterial infections remain a major public health concern, contributing to significant morbidity and mortality worldwide. Understanding the genomic and epidemiological factors that influence bacterial mortality rates is crucial for developing effective risk assessment strategies. In this study, we applied machine learning (ML) models to predict mortality rates of 50 foodborne bacterial species using genomic, virulence, antimicrobial resistance (AMR), and epidemiological features.

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Five regression models were evaluated: Linear Regression (LR), Random Forest (RF), Gradient Boosting (GB), Support Vector Regressor (SVR), and K-Nearest Neighbors (KNN). Our results indicate that ensemble models (RF, GB) outperform traditional linear regression in capturing the complex relationships between bacterial features and mortality rates. Feature importance analysis revealed that annual reported cases worldwide, genome size, GC content, and virulence gene count are the strongest predictors of mortality. Interestingly, AMR gene count had a lower-than-expected impact, suggesting that antibiotic resistance alone does not strongly determine mortality outcomes. SHAP analysis confirmed the significance of genomic and epidemiological factors in shaping model predictions. However, all models exhibited low R^2 scores and high Mean Absolute Error (MAE), indicating room for improvement. Residual analysis suggests that outliers and data variability may be limiting model performance. Future research should explore larger datasets, feature engineering, and advanced deep learning approaches to enhance predictive accuracy. Despite these limitations, this study demonstrates the potential of ML in quantifying bacterial pathogenicity and informing food safety and public health decision-making.

MICRO-P7

Searching for antimicrobial producing microbes in the cockroach gut

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Campbell University

Cockroaches live in pathogen filled environments, ingesting trash and feces. As such, they ingest pathogens on a daily basis without contracting illness. In contrast, if these same pathogens were ingested by humans, it could cause serious illness. Therefore, the population of microbes in a cockroach gut may have certain adaptations to counteract harmful pathogenic infections. The goal of this experiment was to investigate the microbes present in the digestive tracts of wild cockroaches and test for antimicrobial production. First, cockroaches were obtained from various sources including a college campus, businesses, and a domestic residence.

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The cockroaches were identified, and their digestive tract was extracted by dissection with 7 extracted gut samples obtained. A “gut solution” was created and cultured on nutrient agar. Diverse microbial populations were observed, and 57 unique colonies were isolated. The colonies were assayed for antimicrobial production against Escherichia coli (E.coli), Enterococcus raffinosus (E. raffinosus), Pseudomonas putida (P. putida), Enterobacter aerogenes (E. aerogenes), Staphylococcus epidermidis (S. epidermidis), and Enterococcus faecalis (E. faecalis). The percentages of isolate production against the test pathogens included 7.0% production against E. coli., 7.25% against E. raffinosus, 3.5% against P. putida, 0% against E. aerogenes, 15.7% against S. epidermidis, and 0% against E. faecalis (E. faecalis). Data from this experiment will contribute to the future exploration and role of antimicrobial producing microbes in the cockroach gut post ingestion of intestinal pathogens.

MICRO-P8

Novel Nano-Stimulant Promotes Gut Probiotic Growth and Survival via pH Stabilization in Dairy Products

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Long-term survival of probiotic bacteria in yogurt is a recognized challenge for the food industry and consumers alike. Generally, acidic pH between 4.0 and 4.4 are considered optimal for improved flavor and texture in yogurts; however, not all probiotic strains are acid-tolerant, limiting their growth and survival in refrigerated yogurts. Thus, the potential health benefit claims for the probiotics in yogurts, particularly that are in refrigerated shelves for a longer duration, have been questioned. Bifidobacteria are gram-positive, anaerobic probiotic bacteria recognized for their role in promoting gut health and overall well-being. Specifically, low levels of gut Bifidobacteria have been linked to celiac disease, indigestion of complex carbohydrates, diabetes, weight gain/obesity, poor immunity, allergic asthma, and dermatitis.

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In this study, using Bifidobacterium longum HBL79 as a candidate probiotic strain, we explored the potential for a nano-stimulant, citrate-functionalized silver nanoparticles (Cit-AgNPs), to improve the growth and survival of B. longum in low-pH yogurts made from whole milk and ultra-high temperature (UHT) pasteurized milk. To test this hypothesis, agar plates were streaked with yogurt containing Bifidobacteria every two days and the colony forming unites were recorded. Results showed that the nano-stimulant effectively stabilized both yogurts' pH over the 14-day period (mean pH range: 4.0-4.3), whereas a significant drop in pH occurred in both untreated/controlled yogurts between day-2 and day-4. Thereafter, pH of both untreated yogurts generally stabilized over 14 days (mean pH range: 4.1-4.8) with UHT yogurt staying within the optimal pH range (4.0-4.5). Furthermore, the nano-stimulant significantly promoted the growth and survival of B. longum throughout the study period of 14 days in both yogurts, but the growth and survival ceased significantly in untreated yogurts by day 10. Human health promotion through functional foods such as yogurts containing probiotics may utilize nano-stimulants like Cit-AgNPs as a promising modality for the dairy industry.

MICRO-P9

Exploring Synergistic Antibacterial Activity of Camphor Essential Oil

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Guilford College, RJ Reynolds Tobacco

Today, there is an urgent need for alternative antimicrobial agents due to the growing problem of antibiotic resistance. Recently, many conventional remedies have been used in combination with antibiotics, such as native plants. Cinnamomum camphora is a North Carolina native plant that has been increasingly used and has shown anti-inflammatory and antimicrobial properties. Although camphor, derived from the wood of the camphor tree, has inherent antibacterial qualities, its effectiveness can actually be increased by combining it with antibiotics. In this study, the synergistic antibacterial activity of camphor essential oils was investigated against Pseudomonas aeruginosa and Staphylococcus aureus.

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The antibacterial properties of camphor essential oils in combination with different synergistic drugs are assessed in this study using qualitative and quantitative techniques, such as Kirby Bauer assays. Due to possible contamination of S. aureus, only P. aeruginosa was assessed further. Findings showed that combining low levels of antibiotics with camphor create synergistic bacterial inhibition against P. aeruginosa, suggesting a possibility for creating potent natural synthetic antimicrobial treatment combinations. These findings highlight the promise of camphor essential oils as a natural adjunct in antimicrobial therapy, advocating for further exploration into their mechanisms of action and broader applications in healthcare settings.

MICRO-P10

Microplastics, an emerging environmental pollutant, induce DNA damage in vitro

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Microplastics are an emerging environmental pollutant that is present in various environments, including marine ecosystems, soil, and air and has been detected in human blood and different organs. Studies have shown that microplastics have toxic effects on organs and cells; however, the underlying mechanisms remain unclear. DNA is considered one of the main targets of pollutants, as exposure to various environmental pollutants may directly damage DNA molecules, leading to mutations and changes in gene expression, and thus may cause health problems. Polystyrene is the primary type of microplastics found in the environment.

This study investigated the size and dose-dependent effects of polystyrene microplastics on DNA strand breaks using the φX-174 RF I plasmid. We hypothesized that microplastics would induce DNA strand breaks, i.e., conversion from the supercoiled φX-174 RF I duplex DNA form to open circular and linear forms. To examine size- and dose-dependent effects, φX-174 RF I plasmid DNA was exposed to polystyrene microplastics of varying concentrations (0, 1, 10, 50, 100, 500, and 1000 μg/ml) and sizes (0.07, 0.7, and 7 μm) in phosphate-buffered saline at 37°C for 24 h.

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Our results showed that 0.07 μm-sized microplastics increased DNA strand breaks at concentrations of 10, 50, 100, and 500 μg/mL, and 8.19 μm-sized microplastics increased DNA damage at concentrations of 10, 50, and 100 μg/mL. In conclusion, the results of this study highlight the potential for genotoxicity, which will enrich our assessment of the health effects of human exposure to microplastics

MICRO-P11

Carbon nanodots alleviate gut dysbiosis caused by atherosclerosis

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Carbon nanodots (CND) are a new class of nanomaterials with a size of less than 10 nanometers. They have excellent biocompatibility and are widely used in biological imaging, transmission, diagnosis, drug delivery, and regulation of various inflammation-induced diseases. However, the underlying mechanism remains unclear. Atherosclerosis, the leading cause of death in the United States., is a chronic inflammatory disease characterized by the formation of plaque build-up within the arterial walls. Low-density lipoprotein receptor (LdLr-/-) knockout mice are a commonly used mouse model and have been used widely to study atherosclerosis.

This study investigated whether CND could modulate atherosclerosis-induced changes in gut microbial composition. Six-week-old male LdLr-/- mice consume diets with atherogenic diet (containing 10% calories of palm oil and 0.2% cholesterol) for 16 weeks, and subgroups are administrated CND at 2.5 mg/kg of body weight. C57BL/6 mice were fed a standard chow diet as a healthy control. LdLr-/- atherosclerosis mice induce gut dysbiosis by changing several opportunistic and commensal microbes comparing health control. CND increased several gut commensal microbes, including coprococcus, oscillospira, and dorea, while LDLr atherosclerotic mice significantly reduced these commensal microorganisms. Our results suggest that CND may be a potential adjunctive strategy to modulate gut microbiota beneficially.

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MICRO-P12

Applications of forensic microbiology on the decomposition of chicken

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Pfeiffer University

Forensic microbiology has become increasingly popular since the PCR-based genome typing application of bacteria in the early 1990s. It primarily relies on the culturing and molecular analysis of bacterial samples taken from the body of a deceased person, the surroundingenvironment, or an infected person. For this experiment, non-brined chicken breasts and thighs are used as a substitute for the decomposing body. The isolation procedures are based on the FDA April 2023 edition of the Bacteriological Analytical Manual (BAM), to isolate different bacterial populations samples were plated onto nutrient agar, mannitol salt agar, eosin-methylene blue agar, and Hektoen-Enteric agar plates via the spread and streak method and incubated at 37 °C ± 0.5 °C. To identify samples molecularly, using multiplex PCR primer pairs specific to different genera will be used to compare known bacterium against the samples and controls as confirmatory testing.

MICRO-P13

Isolation of Bacillus toyonensis and Mucilaginibacter oryzae from soil and evaluation of antimicrobial extract

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North Carolina State University

Antibiotics are commonly used to fight off bacterial infections, however there is a growing demand for new antibiotics with the rise in antibiotic resistance. Organisms such as fungi and bacteria produce these substances naturally in response to competition and limited resources. Three bacteria were cultivated from soil on R2A media at 30℃. After isolation of isolates PDA1B, PDA11, and PDA12, antibiotic production was demonstrated using Pseudomonas putida, Enterobacter aerogenes, and Enterococcus raffinosus which are safe relatives of antibiotic resistant bacteria.

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Bacterial genomic DNA was isolated and sequenced using nanopore MinION. These isolates were identified as Bacillus toyonensis (PDA1B and PDA12) and Mucilaginibacter oryzae (PDA11). Crude chemical extraction was performed for each isolated and tested against P. putida, E. aerogenes and E. raffinosus as well as eukaryotic hosts Saccharomyces cerevisiae and Salvia hispanica. The extracts from PDA1b and PDA11 inhibited growth of all three bacteria tested. PDA12 inhibited E. raffinosus. The extracts did not inhibit the S. cerevisiae or S. hispanica when compared to the control demonstrating limited toxicity.

MICRO-P14

Evaluation of bacterial soil isolates antibiosis activity in the presence of environmental stressors

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North Carolina State University

Antimicrobial resistance is a rising issue in healthcare settings. In an attempt to mediate this threat on health, researchers have begun the search for antibiotic producing bacteria in environmental samples, such as soil. Therefore, the purpose of this experiment was to search for potential antibiotic producing bacteria in soil and evaluate isolate antibiosis by competing them against relatives of ESKAPE pathogens (safe ESKAPEs).

Any isolates that demonstrated antibiosis were further tested by placing them under environmental stressors in an attempt to increase the production of secondary metabolites. Soil was collected, serially diluted and plated on nutrient agar. Eighteen morphologically unique colonies were picked and tested against the safe ESKAPEs. Seven of the eighteen isolates demonstrated antibiotic potential against one or more of the following safe ESKAPEs: Staphylococcus epidermidis, Escherichia coli, Mycobacterium smegmatis, and Enterobacter aerogenes. These isolates were further evaluated by determining antibiotic production when grown on 25%, 50%, 75%, and 100% nutrient agar.

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ABSTRACTS

Out of the seven isolates, two (SH03a and SH01) demonstrated greater antibiosis against S. epidermidis on 75% nutrient agar. SH03a also showed greater inhibition of E. coli growth when grown on 75% nutrient agar. One additional isolate, SH02a, showed greater inhibition of M. smegmatis and E. aerogenes growth on the 50% nutrient agar. Further testing is being performed to evaluate the effects of nutrient limitation on antibiosis against the safe ESKAPEs. Nutrient deprivation is just one of the many environmental factors that can be used to stress bacteria and in the future, similar experiments will be conducted using UV light.

MICRO-P15

Examining the Antimicrobial Activity of Azelaic Acid Against ESKAPE Pathogen Relatives

Carmony Hartwig - Catawba College

Azelaic acid (AzA), a naturally occurring dicarboxylic acid, exhibits antimicrobial, anti-inflammatory, and anti-keratinizing properties, making it a promising alternative to conventional antibiotics1,2. This study evaluates the antibacterial activity of AzA against ESKAPE pathogen relatives; non-pathogenic relatives to species associated with antibiotic resistance and significant clinical challenges. Using a Zone-of-Inhibition (ZOI) assay, various concentrations of AzA (5%, 10%, 20%) were tested alongside controls (DMSO, Penicillin, Tetracycline) on bacterial lawns of Bacillus subtilis, Klebsiella aerogenes, Staphylococcus epidermidis, and Escherichia coli. Results demonstrated that AzA exhibited concentration-dependent inhibition, with 20% AzA achieving significant growth suppression across all tested species.

Remarkably, AzA inhibited the growth of S. epidermidis to a greater degree compared to standard antibiotics tested, highlighting its potential in addressing skin-associated infections. Statistical analysis via ANOVA with Dunnett's post-hoc test supported the significance of these findings. This research emphasizes AzA’s low risk of resistance development and its suitability as a novel therapeutic candidate, particularly for dermatological conditions like acne and rosacea. Future studies will investigate combination formulations of AzA to enhance skin permeability.

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