North Carolina Academy of Science

120th Annual Meeting Program

North Carolina Academy of Science
Since 1902

WSSU

April 5-6 | 2024

Winston Salem State University

Meeting Theme: "Unleashing Energy"

NCAS President's Welcome

It is my greatest honor and pleasure to welcome you to the 120th Annual Meeting of the North Carolina Academy of Science (NCAS) hosted at Winston-Salem State University. North Carolina Academy of Science has 120 years of rich history. The Academy has been promoting science education and public policies in North Carolina for the past 120 years.

Science is more than research in the laboratory in modern sciences. It is with collaboration and communication. The annual meeting is the culmination of the NC Academy's yearly activities. Through the annual meetings, faculty and students are together to showcase their scientific research endeavor in various fields. I encourage everyone to actively participate in many activities, including poster/oral presentations, keynote lectures, various workshops, and networking with fellow students, faculty, and professionals from many institutions. The annual meeting is the place for meeting people. People you meet today might be your future employers, advisors, colleagues, and supporters. Get to know people as many as you can.

I am certain that the keynote lecture will open your eyes wide to the new world and show you the future of energy. If you have a chance, ask questions, and talk to the special keynote speaker as this might be your once-in-a-life opportunity.

I would like to thank Dr. Anthony Graham, interim chancellor of Winston-Salem State University, for allowing us to use this beautiful campus for the meeting. I would also like to thank the local annual meeting arrangement committee members and all the supporters for their dedication to making this 120th NCAS annual meeting a great success.

Thank you!

Taek H. You
NCAS President, 2023 - 2024

Summary Schedule of Events

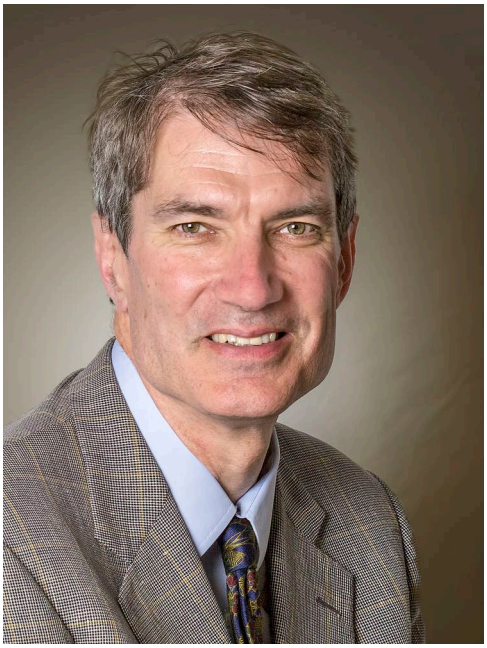
Friday April 5, 2024, New Science Building (NSB)

1:00-2:00	Finance and Strategic Planning Committee, room 210
2:00-5:00	Board of Directors Meeting, room 210
5:00-6:00	Registration and Poster Setup, Lobby
5:30-6:00	Poster Judges Meeting, room 210
6:00-6:15	Welcome Remarks, Lobby
6:00-7:30	Poster Session and Reception with heavy hors d'oeuvres, Lobby

Saturday April 6, 2024 – New Science Building (NSB)

7:30-8:30	Registration, Exhibit setup, Lobby
8:30-1:00	Student Academy Posters, Lobby Available to view; posters will be attended from 9:30-10:30
9:00-11:00	Breakfast, Lobby
7:30-9:50	Practice Rooms available, rooms 232, 234, 318, & 320
8:00-8:30	Judges and Session Moderators Meeting, room 210
8:30-2:15	Exhibits from Meeting Sponsors, Lobby
	1: Sigma Xi **2:** Wake Forest Biomedical Graduate Programs **3:** North Carolina GlaxoSmithKline Foundation: Growing a Diverse Public Health Workforce at East Carolina University **4:** Entomopixel **5:** Winston Salem State University Graduate College
8:30-9:45	Oral Session I, rooms 225A, 225B, 233
10:00-11:15	Oral Session II, rooms 225A, 225B, 233
11:30-12:30	Panel and Lecture (select one of the available options)
	1: Panel Discussion: "Embracing the New Normal: Living Life Post COVID-19," room 225A **2**: Dr. Haozhe "Harry" Wang, "Two-dimensional materials and their emerging applications," room 225B
12:30-1:15	Lunch, Kennedy Dining Hall at Thompson Center Building
1:30-2:30	Keynote Lecture, Dr. Steven Cowley, Director of Princeton Plasma Physics Laboratory, "Getting to Fusion Electricity," DJR Campus Hall (100)
2:45-3:45	Workshops (select one of the available options)
	1: Dr. Jeremiah Shipp, "The Science of Success: Unleashing Your Genius with Small Changes," room 225A **2**: Dr. Carly York, "The Science of Storytelling," room 233 **3**: Dr. Jamie Vernon (CEO Sigma Xi), "Science Policy Initiatives in NC," room 225B **4**: Dr. Katie Johnston, "Soft Skills: The Missing Curriculum in Hard Disciplines," room 221
4:00-4:50	NCAS Business Meeting, room 225B
4:00-4:50	CANCAS Business Meeting & Officers Award Preparation, room 225A
5:00-5:50	Awards Ceremony, room 225B
6:00-6:30	Board of Directors Meeting, room 210

Keynote Speaker



Dr. Steven Cowley

Professor of Astrophysical Sciences and Director of Princeton Plasma Physics Laboratory (PPPL) at Princeton University

Presentation: "Getting to Fusion Electricity"

Biographical Sketch:
Steven Cowley, a theoretical physicist and international authority on fusion energy, became the seventh Director of the Princeton Plasma Physics Laboratory (PPPL) on July 1, 2018, and a Princeton professor of astrophysical sciences on September 1, 2018. Most recently president of Corpus Christi College and professor of physics at the University of Oxford in the United Kingdom since 2016, Cowley previously was chief executive officer of the United Kingdom Atomic Energy Authority (UKAEA) and head of the Culham Centre for Fusion Energy. He earned his doctorate at Princeton University in astrophysical sciences in 1985 and was a staff scientist at Princeton Plasma Physics Laboratory from 1987 to 1993. From 2011 to 2017 he was a member of the UK prime-minister's Council on Science and Technology. He is a Fellow of the Royal Society, the Royal Academy of Engineering, and was knighted by the Queen of England in June 2018.

POSTER PRESENTATIONS – NSB - Friday April 5, 2024 (6:00- 7:30 pm)

Cell and Molecular Biology

Poster number 1

Strickland Alexis* Timothy Anderson, PhD
University of North Carolina at Pembroke

CRISPR-Cas9 cis-editing in Arabidopsis thaliana

Plants that senesce earlier can be taken out of the field faster and minimize vulnerability to disease and extreme weather. Clustered Regulatory Interspaced Short Palindromic Repeats (CRISPR) Cas systems are used to introduce precise genome modifications in model organisms. In this study, the model flowering plant Arabidopsis thaliana is used to study the SENESCENCE ASSOCIATED UBIQUITIN E3 LIGASE1 (Saull) gene. Saull is responsible for plant senescence and has only been studied using gene knockout experiments. The problem with gene knockouts is that when used, knockouts cause the plant to germinate but will die prematurely due to early senescence. To avoid the negative consequences of a Saull gene knockout, cis-editing of the promoter region targeting transcription factor binding sites allows for the investigation of differing transcription levels of the Saull gene and the impact on early senescence. Alteration of upstream regulatory regions of Saull is hypothesized to cause early senescence to A. thaliana. Three transcription factor binding sites have been identified for disruption and gRA's have been designed and cloned into a CRISPR Cas9 gene editing vector.

Poster number 2

Girard, Angelique*, Reynolds, Evan
Campbell University

Rational design of mutations to expand the substrate scope of the thiamine-dependent enzyme SucA

The thiamine-dependent enzyme, SucA, the E1 component of the α-ketoglutarate dehydrogenase complex, is a vital enzyme in the Krebs cycle. While SucA's physiological role is well understood, the application of SucA in organic synthesis has been underexplored. This experiment examines the effect of mutations on the activity of SucA with diverse substrates. Bioinformatics was used to design mutations that we hypothesized would alter the enzyme's substrate scope. These mutants were cloned, expressed, and purified. The SucA variants were then used in reactions with non-natural substrates and activity was verified using LC-MS. This work will illuminate structure-activity relationships with SucA and expand the synthetic chemist's biocatalytic toolbox.

Poster number 3

Salters, Tyrone*, Stisti Palit, Icesis Meeks, and Subir Nagdas
Fayetteville State University

Role of epididymis in the recognition and elimination of non-viable spermatozoa

The mammalian epididymis is essential for sperm maturation and viability, fulfilling the dual functionality of facilitating cellular differentiation and functional preservation. Although the epididymal environment actively promotes sperm maturation and survival, not all spermatozoa remain viable during their passage through the epididymis; the presence of non-viable spermatozoa within the cauda epididymis region has been observed in several species. Degenerating spermatozoa release enzymes that may affect the viability of neighboring cells. The mechanisms protecting against infertility induced by non-viable sperm remain not clearly demonstrated. We previously identified 260/280kDa oligomers, composed of FGL2 (fibrinogen-like protein-2) and FGL1 (fibrinogen-like protein-1), that selectively bind to degenerating sperm in hamster cauda epididymal cells. Our objective in the present study was to elucidate the prothrombinase activity and to identify the potential ligands of FGL2. Utilizing ion-exchange and affinity chromatography, we achieved homogenous purification of soluble FGL2 from cauda epididymal fluid. Time-course studies revealed that FGL2 efficiently converts prothrombin to thrombin, further promoting fibrin polymerization that FGL2 is a lipid–activated serine protease. Moreover, a 56kDa fibrinogen β chain was identified in hamster cauda sperm. Dot blot assays demonstrated that FGL2 binds to specific carbohydrate residues. Co-immunoprecipitation assays indicated that cauda epididymal FGL2 is ubiquitinated, unlike FGL1. Our study illuminates a novel protective mechanism within the epididymis involving FGL1 and FGL2, functioning as biochemical sentinels that segregate viable from defective sperm, thus maintaining sperm viability. These findings provide a foundational understanding of an overlooked facet of male reproductive biology and create a platform for future therapeutic interventions.

Poster number 4

Van Winkle, Rachel*, Evan Reynolds
Campbell University

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

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.

Poster number 5

Bibi, Sumiya*, Evan Reynolds
Campbell University
Investigation of the S321A variant of the thiamine-dependent enzyme SucA in abiological carbon-carbon bond-forming reactions
Thiamine-dependent enzymes are notable for their ability to forge new carbon-carbon bonds, a valuable transformation in synthetic chemistry. The enzyme we focused on in this study is the E1 subunit of the 2-ketoglutarate dehydrogenase complex (SucA). Structural examination of SucA led to design of the mutation S321A, which we hypothesize will alter the substrate scope of the enzyme. The activity of the S321A variant was compared with the wild type enzyme in reactions with non-natural substrates. We expect that this work will provide useful information on the structure-activity relationship for SucA and will expand its usefulness for abiological catalysis.

Poster number 6

Woodlief, Nicholas*, Evan Reynolds
Campbell University
Asymmetric radical catalysis with thiamine-dependent enzymes
Thiamine-dependent enzymes utilize a N-heterocyclic carbene (NHC) species derived from thiamine to catalyze carbon-carbon bond-forming or breaking reactions. Similar synthetic NHCs have been shown to catalyze many reactions not found in nature, such as radical reactions. Inspired by these discoveries, we hypothesize that thiamine dependent enzymes can catalyze radical reactions with high yield and high selectivity. To test this hypothesis, we have performed a model reaction between α-ketoglutarate and methyl α-bromoisobutyrate catalyzed by the thiamine-dependent enzyme SucA. Preliminary LCMS analysis of the reaction indicates enzyme dependent formation of product, suggesting that the enzyme is performing radical chemistry. The successful completion of this work will provide an environmentally friendly approach to catalysis of novel radical transformations.

Poster number 7

Walker, Ronaii*, Yufang, Bao
Fayetteville State university
Thyronomality: Unraveling Thyroid Patterns with Support Vector Machine and Decision Trees
Thyroid disease remains a prevalent health concern affecting 20 million Americans annually, with a concerning 60% of cases undiagnosed. The Bao lab uses machine learning algorithms that include the Support vector machine (SVM) and decision trees as classification methods to identify contributing factors to thyroid disease. We developed a new classification algorithm to improve the accuracy of classifying the thyroid function for patients. Our analysis involved categorizing data into three classes: hyperthyroidism, hypothyroidism, and normal thyroid function (Classes 1-3). We utilized R code to construct decision trees, revealing that for patients on thyroxine treatment, the Free Thyroxine Index is a primary indicator on identifying the thyroid function, and thyroid-stimulating hormone (TSH) emerged as the pivotal factor influencing thyroid disease occurrence for patients not on thyroxine. Class 3 accounts for more than 90% of instances with a TSH value less than 0.0061 nmol/L. Focusing on the remaining data, we employed the SVM to construct a prediction model assessing the likelihood of their class belongings. We used the one vs one approach and repeated SVM classification for the remaining classes. This procedure was reiterated to prioritize three classes in order and the final decision is made by using the mode of the resulting classifications. A reclassification SVM was also utilized for error correction. Our results indicate an encouraging accuracy rate of approximately 99.78% on training data, and an accuracy rate of approximately 98.60% on testing data, suggesting the potential efficacy of the developed model in predicting the three thyroid functional classes. This study contributes valuable insights into the factors influencing thyroid disease, emphasizing the significance of TSH and showcasing the predictive capabilities of support vector machines together with decision trees in identifying at-risk individuals. Further refinement and validation of the model could offer a promising tool for early thyroid disease detection and intervention.

Poster number 8

Johnson, Niore, Ewunkem Akamu, Justice Brittany, Jeffery Meixner
Winston Salem State University
Honeybees-Promoted Safe and Greener Synthesis of Silver Nanoparticles and their Antimicrobial Activity against pathogenic Klebsiella pneumoniae
Honeybees-Promoted Safe and Greener Synthesis of Silver Nanoparticles and their Antimicrobial Activity against pathogenic Klebsiella pneumoniae

Poster number 9

Beonka Sharpe*(1,2,3), Jen Ricano(2), Jiegen Chen(2), Yaomin Wang(2), Nathaniel Hernandez(2,3), Andrea Nackley(2,3)
(1)Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville NC 28310; (2)Center for Translational Pain Medicine, Department of Anesthesiology, Duke University School of Medicine, Durham NC 27705; (3)Department of Pharmacology and Cancer Biology, Duke University School of Medicine, Durham NC 27705

Measurement of orofacial pain in a mouse model of chronic primary pain

Chronic primary pain conditions (CPPCs), including pelvic pain, lower back pain, and temporomandibular disorder, affect one in three Americans. Previous work in our lab demonstrated that low activity of the catechol-o-methyltransferase (COMT) enzyme and corresponding increases in catecholamine levels cause widespread pain affecting abdominal, back, and plantar sites through activation of adrenergic receptor β3(Adbr3). Yet, pain at orofacial sites characteristic of temporomandibular disorder has not been evaluated in our mouse model of CPPCs. Thus, here three groups of female wild-type or COMT+/- mice were exposed to three days of swim stress or sham stress, followed by a molar extraction or sham surgery. Using this model, we conducted three behavioral tests on the orofacial region of the mouse. We measured grimace (spontaneous pain), feeding behavior (non-evoked pain), and orofacial Von Frey (evoked pain) over 14 days, with the operator blinded to the conditions of the mice. Compared to wildtype mice, COMT+/- mice undergoing stress and molar surgery intervention exhibited greater grimace scores, reduced attempts to drink condensed milk, and increased hyperalgesic responses to punctate von Frey stimuli. Suggesting that grimace, feeding behavior, and orofacial Von Frey are valid behavioral measures of chronic orofacial pain. Based on these preliminary results, further testing, and implementation of these three behavioral assays to the array of behavioral tests on the abdomen, paw, and back will further elucidate the mechanism behind these overlapping CPPCs.

Poster number 10

DeLustro, Jennifer*, Dr. Andrea Perreault
Elon University

Evaluating Cell-Specific Differences in Breast Cancer Subtypes Through Integrative Genomics

Breast cancer (BC) is one of the most common forms of cancer that affect women around the world. The disease can be divided into four distinct subtypes: luminal A, luminal B, HER2-positive, and triple negative. The defining characteristics of each subtype are related to the presence or absence of three specific hormone receptors (estrogen, progesterone, and human epidermal growth factor 2). Luminal A and luminal B BC subtypes can usually be managed using hormone therapy, while HER2-positive and triple negative BC subtypes have fewer hormone receptors and need a more aggressive treatment plan. However, previous studies have shown that BC tumors are heterogeneous, meaning they consist of cells belonging to more than one subtype. Heterogeneity complicates the treatment process and may explain why some BC patients come out of remission following the completion of their treatment regimen. This project aims to show there are clear distinctions and similarities when comparing the luminal A and triple negative subtypes using an integrative approach. Integration of multi-omic data including gene expression, transcription factor binding locations, chromatin accessibility, and the 3D organization of the genome allows for the visualization of a multitude of cell-specific characteristics at the genomic level. Computational analysis (using self-generated code in UNIX and R) on publicly available RNA-seq data revealed there is a wide variety of differentially expressed genes between the luminal A and triple negative subtypes, in addition to "normal" breast tissue. Publicly available ChIP-seq and ATAC-seq data were analyzed to determine if these differences in gene expression are due to transcriptional regulation or organization of chromatin. Taken together, these results provide a complete genomic profile of luminal A and triple negative BC subtypes and allow for the identification of molecular differences between these BC subtypes.

Poster number 11

Fredrick, Ally*, Jacy Noble, Erin Witalison
Catawba College, Salisbury, NC

Effects of UV Radiation on MCF-7 Breast Cancer Cells

Epithelial cells play a key role in protecting our body from hazardous environmental factors. The most detrimental threat to our cells is the sun because excessive sun exposure can lead to numerous pathologies, as well as sunburn and premature aging. The sun exposes our cells to harmful UV rays, including UVA and UVB rays. Since our skin is our body's first line of defense, epithelial cells are the primary cells affected by sun exposure. This prompted our research to question what is happening on the molecular and genetic level to our cells after exposure to UVA, UVB, and UVC rays. For this project, we are using MCF-7 breast cancer cells cultured under standard, sterile conditions. Our preliminary studies exposed MCF-7 cells to UVC radiation in different time increments (10 seconds up to 2 minutes) to identify non-lethal UVC exposure that will be the focus of our future studies. It is already well-known that UVC exposure is lethal to cells, but we are interested in determining the molecular effects of low exposure that does not induce a significant decrease in viability. After UVC exposure, we incubated cells for 24 hours to allow for DNA damage responses. Then, we used a Resazurin assay to measure the effect of UVC exposure on MCF-7 cell viability, and a Comet assay to quantify the extent of DNA damage caused by exposure to UVC. These techniques, along with RT-PCR and Western blotting, allow us to observe changes to DNA damage and oxidative stress response pathways. We plan to expand our study to also compare the effects of UVA and UVB exposure. Our results can ultimately help improve our understanding of DNA damage and oxidative stress caused by UV radiation.

Poster number 12

Alexandra Friel*, Lei Zhang, Andy Meixner*
Winston Salem State University

Treatment of Staphylococcus aureus Using Ultrasound

Staphylococcus aureus is a gram-positive cocci of medical importance. Ultrasound in the 35 kHz frequency has been investigated as a novel method used to treat/kill these bacterium. Here, we explore the efficacy of 28 kHz and 40 kHz ultrasound in the treatment of bacterial infection.

Poster number 13

Bonds,Daria*, Olusegun Ariwodola, Sarah Adjei-Fremah
Winston-Salem State University

GenX Chemical exposure alters mitochondrial membrane and function in HepG2 Cells

Per and polyfluoroalkyl substances (PFAS) are persistent environmental contaminants that pose potential health risk to humans. GenX, a novel PFAS compound with short chain and an alternative to PFAS types PFOA and PFOS. While the health effects of PFOA and PFOS have been extensively studied, there is limited research on the impact of GenX exposure on cellular processes. Mitochondrion, a key cellular organelle responsible for energy production and cellular homeostasis, is the potential target of GenX toxicity. This study aimed to investigate the effect of GenX exposure on mitochondrial membrane potential and functionality. Human HepG2 liver cells were treated with GenX (10 nM to 1000nM) and incubated for 48 hrs or 96 hrs. Mitochondrial function was assessed through mitochondria stress (ROS), ATP production and changes in membrane potential were monitored using JCI fluorescent probe. Results showed diminished mitochondrial function, particularly at higher concentrations (1000 nM) and longer durations (96 hours). ATP production decreased, while mitochondria stress increased, indicating potential oxidative stress. GenX also lowered mitochondrial membrane potential, suggesting structural disruption. These findings highlight GenX's potential mitochondrial toxicity and implications for cellular and systemic health. Therefore, it warrants further investigation into molecular mechanisms and long-term effects of GenX.

Chemistry

Poster number 14

Turley, Mia L.*, Abigail G. Riccardi, Mayra McKenna, Cole B. Rigsby, Adam L. Moser, Brian C. Goess, Sarah K. Goforth
Campbell University*, Furman University

Effects of substituents and reagent concentrations on the kinetics of benzyl silyl ether oxidation

The kinetics of the Ru-catalyzed oxidation of benzyl silyl ether in an EtOAc/water biphasic is being studied to understand the mechanism of silyl ether oxidative deprotection. The reaction order was determined using NMR by plotting substrate loss vs. time with zero-, first-, and second-order kinetics. Concentrations of reagents including substrate and solvent were modified to assess the effects on the reaction rate and substrate/products. Substituent identity and ortho-, meta-, and para- location were varied to determine the electronic and steric effects on the reaction rate and product ratios. Hammett plot analysis for a series of para- and meta-substituted substrates with electron-withdrawing or donating ability suggested an electron deficiency in the transition state of the rate-determining step.

Poster number 15

Kellar, Kyle J.*, Jeremy M. Walker, Sarah K. Goforth
Campbell University

Development of a pedagogical multistep synthesis involving alcohol bromination and Williamson ether synthesis

A multistep synthesis involving alcohol bromination followed by Williamson ether synthesis has been developed for an Organic Chemistry II laboratory sequence. In pursuit of milder and safer conditions for the alcohol bromination step, lower equivalents of HBr were tested, and the reaction was then optimized according to time and the heating method. The multistep synthesis has been developed enough for the reactions and product isolation to be completed within a single 3-hour lab period followed by product analysis in a second lab period. Students can analyze their alkyl bromide product by MP and NMR, while the ether product can be analyzed by GC. Additionally, TLC and IR are being tested as other potential analysis methods. This newly developed multistep synthesis experiment is being incorporated into Organic II laboratories with students for the first time this semester.

Poster number 16

Lederer, J. Abigail*, Calleigh Connolly, Laura Trivett, Jovanna Valentine, Arianna Hunsucker, Abigail Riccardi, Elizabeth D. Blue, Sarah K. Goforth
Campbell University

Exploring student pitfalls in the procedure for a pedagogical laboratory involving electrophilic bromination of trans-stilbene

The traditional reaction conditions for the bromination of stilbene use liquid Br2 and chlorinated solvent, but as these compounds introduce numerous health hazards into the laboratory environment, many teaching labs instead implement a greener reaction

technique that utilizes HBr, H2O2, and ethanol in place of harsher reagents. This technique creates Br2 in situ by adding 48% HBr solution followed by 30% H2O2 solution to refluxing trans-stilbene in ethanol, creating a safer procedure for most teaching laboratory environments. While the reaction typically results in high yields and pure product, students occasionally observe wide melting point ranges, suggesting the formation of unintended side products beyond the meso-1,2-dibromo-1,2-diphenylethane target product. The procedural differences causing this phenomenon are currently unknown. Potential pitfalls including mistakes in timing/order of reagent addition, amount of HBr, and pH adjustment are being intentionally tested to determine the source of product impurities observed by students. The identity and purity of reaction products will be primarily analyzed by melting point and 1H NMR.

Poster number 17

Perez, Mina*, Guo Fenghai
Department of Chemistry, Winston-Salem State University
Investigations of Conjugate Additions to Thiochromones
Grignard reagents is one of the most widely used organometallic reagents in carbon carbon bond formations in Organic Synthesis. We investigated the reactions of Grignard Reagents to thiochromone catalyzed by copper salts. The hypothesis is that copper salts will affect the conjugate addition of Griganard reagents instead of 1,2-addition to the carbonyl group to allow the synthesis of thiochromanone, an important class of organosulfur compounds with rich bioactivities. Excellent yields of 1,4-adducts – thiochromanones can be isolated (up to 90%) under optimal conditions using copper(I) salts with lithium chloride. A large number of commercially available Grignard reagents can undergo conjugate addition to thiochromones to furnish 1,4-adduct in excellent yields. This approach works well with both alkyl and aromatic Grignard reagents, thus providing a unified synthetic approach to privileged 2-substituted thiochroman-4-ones and a potential valuable precursor for further synthetic applications towards many pharmaceutically active molecules. The use of commercially available or easily prepared Grignard reagents will expedite the synthesis of a large library of thiochromanones for further synthetic applications and biological studies.

Poster number 18

Foster, Bobbi*, Eliza Buhrman, Greg Buhrman, Cyndel Gracieux-Singleton, Gabriel Harris
North Carolina State University
The dark side of dark chocolate: Quantitation of toxic heavy metals in dark chocolate by ICP-MS
Cadmium (Cd) and Lead (Pb) concentrations in Lindt dark chocolate bars containing 70%, 85% and 100% cocoa respectively were measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Cd and Pb are known contaminants in chocolate and concentrations have been positively correlated to cocoa levels. Serious health risks are associated with over exposure to both metals. Prolonged exposure to Pb can result in neurodevelopmental defects, primarily in younger children, and reduced cardiovascular or renal functions in adults. Long-term dietary exposure to Cadmium can cause reduced kidney function. The isotopes Cd-111, Cd-114, and Pb-208 were quantitated by ICP-MS using a seven-point standard curve ranging from 0.01 – 10.0 ppb Cd and Pb. To prepare samples for ICP-MS, chocolate was digested by microwave-assisted acid digestion. The concentration data was recalculated as the percentage of daily allowance per 1 ounce of chocolate to compare our data to previously published reports using California's Maximum Allowable Dose Level (MADL) of 0.5 μg per day for Pb (known as the safe harbor level) and 4.1 μg per day for Cd. Our results showed an increase in Pb to levels above 100% MADL for 85% and 100% cocoa chocolate. Our results also showed an increase in Cd levels above 100% MADL for 100% cocoa bars. Only the 70% cocoa bar was below 100% MADL for both Cd and Pb. Our results are consistent with previously published consumer reports.

Poster number 19

Womack, Reagan*
Lenoir-Rhyne University
Computational analysis of human prion protein's allosteric potential reveals potential pharmacological chaperone binding site for V189I and V203I PrPSc
Chaperone molecules facilitate correct folding pathways to assist in proteins folding to their native conformation. For proteins that do not fold spontaneously, chaperonins may be required for folding to occur. This idea can be applied to already misfolded proteins by attaching a protein to a misfolded protein that destabilizes the misfolded conformation and assists in folding the protein back into its native conformation. Prion diseases are rare neurodegenerative diseases characterized by tissue deposition of a misfolded isoform of the cellular prion protein. The purpose of this study was to identify a potential site for pharmacological chaperone molecules to bind to on human prion protein that may aid in stabilizing the native conformation of the protein or protect a normally folded protein from being attacked by the infectious isoform in the presence of V189I or V203I mutations. Two PDB structures were obtained from the Protein Databank (PDB) for analysis (1QM2 and 1I4M). Eris, a protein stability prediction server was used to perform an exhaustive analysis of missense mutations on prion protein. The results from this analysis were compared to the list of infectious missense mutations to the PRNP gene obtained from the Human Gene Mutation Database (HGMD). The ProteinLens webserver was used to compute Markov transient times for each residue with the source site set as the site of a missense mutation. These results were then used to test potential regulatory sites by exploring the effect of small probe binding and simulated mutation with the AlloSigMA server. Data was extracted from each server and analyzed using statistical methods in R and Python to locate any abnormalities and inconsistencies in the data. The results from these computational analysis tools suggest residues 167, 195, and 197 of human prion

protein are all potential targets for pharmacological chaperone molecule binding.

Poster number 20

Nabinett-Jackson, Kayla*, Guo, Fenghai
Winston-Salem State University
Novel one-pot synthesis of thiochromones and selenium analogues
Abstract: Heterocycles including selenium, surfur-containing heterocycles have widespread applications in biomedical fields due to their rich biological activities. This research will explore the novel one-pot reactions of 3-aryl(seleno)-propanoic acid and 3-aryl(thio)-propanoic acids from corresponding selenols and thiols via SN2 reactions. The one-pot synthesis is appealing due to the less steps in synthesis, purification thus less waste produced. The hypothesis is that the electronic withdrawing and donating group on the aromatic ring will affect the reactivity of 3-aryl(seleno)-propanoic acids, 3-aryl(thio)-propanoic acids and thus the efficiency in the synthesis. 3-aryl(seleno)-propanoic acid are important intermediates for novel selenium heterocycles synthesis. The scope of 3-aryl(seleno)-propanoic acid and 3-aryl(thio)-propanoic acids will be explored for the one-pot reaction in the synthesis of selenolchromone as well as thiochromones.

Poster number 21

Simpkins, Kahlia*, Fenghai Guo
Winston-Salem State University
Development of Intramolecular Friedel-Crafts Acylation Reactions for the Synthesis of Thiochromones
Friedel-Crafts acylation reaction is one of the most useful electrophilic aromatic substitution reactions. This research is focused on the intramolecular Friedel-Crafts acylation of 3-(phenylthio)-propanoic acids and derivatives in the synthesis of sulfur-containing heterocycles. The hypothesis is that the electronic withdrawing and donating group on the aromatic ring will affect the reactivity and chemical yields of these Friedel-Crafts acylation reactions. The scope of 3-(arylthio)-propanoic acids with both electron-donating and electron-withdrawing groups on the aromatic rings will be explored. The results on various electron-donating and electron-withdrawing groups such as F, Cl, -OMe, -CF3, -Me will be presented. A number of Lewis acids such as aluminum chloride, iron (III) chloride will be investigated to find the optimal reaction condition. This project is part of the NSF CUR-TP project - infusion of research into Organic Chem II lab at WSSU.

Poster number 22

Smith, Aryanah
Wake Technical Community College
Environmentally friendly biomaterials for photovoltaic cells
•Photovoltaic cells, commonly known as solar cells, are semiconductor devices that convert sunlight directly into electricity. Solar cells are crucial in solar power systems, which use clean and renewable energy sources. Photovoltaic cells operate on the principle of the photovoltaic effect. When photons from sunlight strike the semiconductor material within the cell, they excite electrons, creating an electric current. This current can be harnessed and used as electrical energy. Photovoltaic cells are used in various applications, from small-scale solar chargers and residential rooftop installations to large utility-scale solar farms. They can provide electricity for homes, businesses, and even off-grid locations. The project was designed to develop a solar cell based on a natural dye as the light-absorbing source. Three different types of natural anthocyanin dyes including blackberry, raspberry, and hibiscus will be analyzed and found the most effective dye for a low-cost, efficient solar cell. The solar cell is built on TiO2-coated conductive glass plates. The voltage and current of the blackberry dye-based solar cell are measured and analyzed with raspberry and hibiscus. HOMO-LUMO gap studies will be also employed to identify a natural dye which absorbs light at longer wavelengths.

Poster number 23

Lara, Adriana*, Morris, Vanessa, Dr. Sujatha, Narasimhan, Dr. Autrey, Daniel and Dr. Gautam, Bhoj
Wake Technical Community College, Raleigh, NC; Department of Chemistry, Physics , and Materials Science, Fayetteville State University, Fayetteville, NC
Etching Condition dependence X-ray Patterns in Two Dimensional MXenes
In this work, we investigated etching conditions on X-ray patterns in two dimensional MXenes. We synthesized different batches of Ti3C2TX MXenes by tuning temperature. We observed the shift in 002 peak of Ti3C2TX to lower angle side when it is synthesized with elevated temperature. This indicates that interlayer spacing can be tuned by change in temperature.

Poster number 24

Phan, Nam*
Wake Technical Community College, and North Carolina State University
Low-cost dye-sensitized photovoltaic cell developed with hibiscus sp.
This study presents a quantitative analysis of the potential usage of hibiscus dye-sensitized solar cells as an alternative solution to silicon-based solar cells. The low-cost, dye-sensitized solar cells are prepared using TiO2-coated transparent conductive glass plates. The dye efficiency is analyzed using the measurements of the HOMO/LUMO gap and the power produced by the TiO2 Hibiscus dye solar cell. Afterward, the efficiency of TiO2 Hibiscus dye solar cells is compared with two other natural dye-sensitized solar cells. The most effective natural dye-sensitized solar cell can be a possible source to power Wake Technical Community College's northern campus. The open-circuit voltage (Voc) produced by this dye-sensitized solar cell should be between 0.268 and 0.65V based on the current research done using hibiscus dye.

Poster number 25

Bledsoe, Gage*, Feeney, Mark, Dr. Howard, Jason
Wake Technical Community College
Spin Coating Control Automation and Design
This project explores the design behind automating the process of spin-coating with a controller box for educational purposes. This project strives to answer the question: "how can spin-coating be automated for an interactive experience with the audience in a way that allows them to learn?" Exploring this question, we discovered methods of mini-computer incorporation, specifically the Raspberry Pi and Arduino, Python coding, and digital/analog system design to serve as a productive answer. Providing a hands-on experience for the audience, this research finds that given the speed and solution input, through the choice of knob and button selections, this design can register that information and give an appropriate output. The highlights of this project include 3D SOLIDWORKS modeling, Python programming, circuit design, and hardware assembly; this results in an educational experience for the user to witness and learn about the spin-coating process.

Poster number 26

Qays-Grier,Jalaa*1, Sarah Adjei-Fremah 1, Simone Smith 2, Jude Ewunkem 1, and Ilunga Tshimanga 1.
1Winston-Salem State University, 2 North Carolina Agricultural and Technical State University
Identification of phenolic compounds in Bryophyllum pinnatum leaf using different organic solvents
Bryophyllum pinnatum (Lam.), is a perennial native plant from Madagascar and belong to the family Crassulaceae. The leaves are widely used in traditional medicine due to their biological activities for the treatment of several diseases, including inflammation, hypertension, kidney stones, gastrointestinal disorder, and other oxidative processes. The medicinal and pharmacological properties of Bryophyllum pinnatum are attributed to the presence of secondary phenolic compounds. This study aimed to elucidate the phenolic composition of Bryophyllum pinnatum leaf extract using different organic solvent. Preparation of the leaf extracts involved methanol and ethanol as solvents. The methanol and ethanol leaf extracts were analyzed for total phenolic content using the Folin method and total protein concentration using the BCA method. Additionally, the antioxidant capacity of the extracts was quantitatively assessed using the Oxiselect antioxidant assay. Subsequently, high performance liquid chromatography (HPLC) analysis was done to identify major phenolic constituents within the extracts. The study results showed higher total phenolic content, and total antioxidant capacity in the ethanol-based BP extract compared to methanol-based extract. Ethanol-based BP extract had elevated total protein concentration (2610.14±5.68 µg/mL) than methanol BP extract (2464.16 ±2.94 µg/mL). These results indicate that the choice of extraction solvents affect the extraction efficiency of phenolic compounds in BP leaf. HPLC analysis identified three flavonoid compounds- kaempferol, quercetin, myricetin in both methanol and ethanol extracts. The study findings demonstrated the importance of solvent selection in optimizing the phenolic profile in BP leaf for potential therapeutic application. In addition, the identification of these flavonoids compounds contributes to understanding the phenolic composition of BP and potentially correlating with its medicinal properties.

Ecology, Botany and Zoology

Poster number 27

Wasserberg, Noga*
UNCG-Middle College
Are mosquitoes afraid of mosquito fish?
Background. Mosquitoes are the deadliest animal in the world because they transmit deadly diseases. To control mosquitoes, people use insecticides that might be toxic. Biological controls are better because they are environmentally friendly. In this experiment, I worked with Gambusia affins, a fish that is used to control mosquitoes.
Study question. Do mosquitoes avoid laying eggs in cups containing fish or fish-water?
Hypotheses: I hypothesized that mosquitoes would avoid laying eggs in cups containing a fish (experiment 1) or fish-water (experiment 2) because they do not want their larvae to be eaten.
Method: I used plastic cups containing water and a germination paper. In the first experiment, I placed six pairs of cups: one with and one without a Gambusia fish. In the second experiment, I produced "fish-water" by placing 12 fish in 1-gallon of dechlorinated water for

three days. In the field, I used seven pairs of cups: one with "fish-water" and the other with regular water. Papers were collected after a week and eggs were counted under the microscope.
Results. In the first experiment, as expected, the mosquitoes laid more eggs in cups without fish than in cups with fish. However, in the second experiment results contradicted our hypothesis: mosquitoes laid more eggs in cups containing "fish-water".
Conclusions: In the first experiment, the results supported my hypothesis but in the second experiment, results contradicted my hypothesis. These results suggest that mosquitoes detect the presence of the Gambusia fish not by taste or smell but rather by sight.

Poster number 28

West, Noah*
Guilford College

Are Savannas more Flammable than Gallery Forests? A Community and Species Level Analysis

Gallery forests are facing higher rates of fire due to increasing drought stress and higher global temperatures. This fire sensitive ecosystem already faces threat from the presence of regular fire in the surrounding savanna ecosystem. Changes in its community composition from encroaching savanna vegetation can result in increased community flammability and an altered fire regime. Identifying high flammability species to protect gallery forests is critical to sustain the role and diversity of this ecosystem. To achieve this we determined flammability of 51 species across both ecosystems by defining flammability as a combination of maximum temperature, burn time, and burn biomass. We also measured other plant functional traits such as leaf area (LA), leaf mass per area (LMA), and leaf dry matter content (LDMC); and fuel moisture content (FMC) to examine how these traits influence flammability. We found that flammability was lower in the gallery forest in terms of maximum temperature and burned biomass, but not burn time. While gallery forest species generally had the lowest flammability, one savanna species, Grevillea mimosoides, had notably low flammability. This may be beneficial for further studies as a green firebreak species to protect gallery forest or properties within the savanna. Due to its proximity to water, the gallery forest species had a higher moisture content seen in their low LDMC values. Gallery forest species also had exhibited a greater loss of fresh weight. Maximum temperatures were negatively associated with FMC. LA and LMA were not significant. The high LDMC values in savanna species results in higher burnt biomass. This study implies that species with low flammability should be used as green firebreaks between savanna and gallery forest ecosystems. To protect gallery forests from wildfire measures such as controlled burns early in the dry season should be enacted.

Poster number 29

Fender, Jackson*, Chunco Amanda, Kingston Michael
Elon University

The lightbulb tunicate (clavelina oblonga): a study of climate Ccange, invasion ecology and risk assessment

Clavelina oblonga, also known as the lightbulb tunicate, is a species native to the Caribbean. Over the last 80 years, it has become invasive throughout western Europe and on the eastern seaboard of the United States from South Florida to portions of South Carolina and most recently Beaufort, NC. This isolated invasion has putatively occurred through ballast water in shipping and has thrived potentially due to changes in climate factors such as water temperature. This research seeks to identify: 1) the geographic patterns in this species spread from the native range, 2) environmental factors contributing to these invasions, and 3) surrounding areas that may be at risk. Based on resources including using museum and citizen science records mapped in ArcGIS, we have developed a sampling methodology that covers the coast of North Carolina with primary data collection occurring in June, where we will use a sampling apparatus to scrape wharf pilings under docks and identify the species we collect. Using these maps, we can determine which areas are at high risk for an invasion, as well as determine how influential factors like climate change are impacting species movement.

Poster number 30

Nitsche, Hope*, Johnson, Erik, Rizzo, Mike
Wake Forest University

Evaluation of factors regulating Drosophila neuropeptide F (NPF) neuronal activity

Neuropeptide F (NPF) is a well characterized invertebrate neuropeptide that is involved in the regulation of feeding behavior and hunger signaling. However, the regulatory factors that control NPF release are not fully characterized. We sought to investigate NPF regulatory inputs through a combination of behavioral assays and live-cell imaging. Through the use of the capillary feeding assay (CAFE), we found a significant decrease in compensatory feeding in starved adult male Drosophila when overexpressing the nutrient sensing AMP activated kinase (AMPK), suggesting a role for this cellular energy sensor in sexually dimorphic regulation of NPF neuronal activity. NPF is also expressed in P1 neurons, a population of neurons only present in adult male flies which are associated with aggression and courtship behaviors. GCaMP imaging of NPF expressing P1 neurons showed inhibition following application of crustacean cardioactive peptide (CCAP). P1 neurons have been previously shown to be indirectly inhibited by CCAP application through of the activity of insulin producing cells (IPCs). Our findings suggest that NPF may be acting in a sexually dimorphic manner in male and female Drosophila to regulate NPF signaling. Further research needs to be done to confirm the proposed mechanism for this phenotype and to determine whether CCAP acts directly or indirectly to regulate NPF neuronal activity.

Poster number 31

Dankner, Sam*, Johnson, Erik, Rizzo, Mike
Wake Forest University

Activation of larval Drosophila leucokinin neurons by canonical TRPA1 agonists

Transient receptor potential (TRP) channels are a superfamily of non-specific cation channels with key roles in somatosensation and other sensory systems. These channels are expressed in both the central and peripheral nervous system. In Drosophila, the TRP channel dTRPA1 mediates both thermal sensitivity and nociceptive responses to the reactive electrophile allyl isothiocyanate (AITC), the molecule responsible for the pungency of horseradish and wasabi. Previous investigations have shown that dTRPA1 is expressed in a subset of leucokinin (LK) expressing neurons in the adult central nervous system, but this phenotype has not been fully evaluated in larvae. We expressed the genetically encoded calcium indicator GCaMP in larval LK neurons to assess whether these neurons were also activated by canonical dTRPA1 ligands. We found that some larval LK neurons are responsive to AITC and that these same neurons are also activated by the bacterial endotoxin lipopolysaccharide (LPS). These findings suggest that a subset of larval LK neurons express dTRPA1 and may regulate larval thermo- and chemosensitivity, while suggesting a potential role for LK in immune response to bacterial infection.

Poster number 32

Jones, Emily*, Hirshman, Lexi, McGee, Sebastian, Fisher, Charlie, Panagopoulos, Labrini, Gfroerer, Riley, Rizzo, Mike, Talyn, Becky, Johnson, Erik
Wake Forest University (All except Becky Talyn), California State University San Bernardino (Becky Talyn)

Exposure to glyphosate-based herbicide impacts Drosophila survivorship, behavior, and internal microbiome

As the use of glyphosate-based herbicides worldwide continues to increase, there are increased concerns regarding potential adverse effects on non-target organisms. Multiple studies have suggested glyphosate, an 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase inhibitor, may negatively impact host microbiome populations. To evaluate this hypothesis, we exposed Drosophila melanogaster to the glyphosate-based herbicide Roundup® Super Concentrate to determine the effects on the microbiome, survivorship, and egg-laying behaviors. Flies housed on media supplemented with Roundup® demonstrated reduced survivorship when compared to flies housed on standard media, and this reduction in lifespan was correlated with altered microbiome populations based on both colony forming units (CFU) and 16S sequencing analysis. We also found that adult female Drosophila preferentially avoided laying eggs on Roundup® supplemented media in a two-choice oviposition assay. Our results suggest that Roundup® may disrupt the Drosophila microbiome, while also influencing oviposition behavior and overall survivorship. These results suggest that glyphosate-based herbicides may have negative impacts on non-target organisms, raising concerns about the impact of their increased utilization.

Poster number 33

Williams, Wesley Allen*, Shyam Aravamudhan
North Carolina Agricultural and Technical State University/Joint School of Nanoscience and Nanoengineering

Reliability Testing of Machine Learning Model Prediction Capability towards Unidentifiable Microplastic Spectral Data: Triple Battery and Colorant Investigation

1800 spectral data points (900 from μ-FTIR and 900 from μ-Raman) from commercial means were acquisitioned as a baseline for ML Model creation: 100 samples each from cellulose acetate (CA), high-density polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polymethylmethacrylate (PMMA), polyamide-6 or nylon-6/nylon-66 (PA6), and polyvinyl chloride (PVC). In order to truly test the reliability of our models towards real-world data, 3 rounds of testing with synthetic data (SD), mixed synthetic data (MSD), and real-world data from an FTIR library of plastic particles sourced from the environment (FLOPP-E) and a spectral library of plastic particles aged in the environment (SLOPP-E) was administered. Firstly, the models were narrowed down to a suite of 14 (12 from MATLAB Classification Learner Application and 2 from SAS Viya for Learners) with an accuracy cutoff of 90%. From there on, SD was created that generated 100 spectra representing all plastic classes except PS (μ-FTIR) and CA and PS (μ-Raman). The subspace k-nearest neighbors (SKNN) and wide neural network (WNN) performed well for both characterization modes (μ-FTIR and μ-Raman) with an accuracy of, 99%/100% and 98%/100%, respectively in terms of models. Only SKNN was seen as statistically significant according to Kruskal-Wallis (K-W) ANOVA test across both characterization modes ($\chi 2$ = 31.99/69, p = .0024/<.0001). MSD revealed a plausibly predictable pattern from μ-Raman's SKNN only as determined by K-W H testing (H = .25 - 6.59, p = .156 - .993) showcasing the progenitor of multi-class prediction with an ensemble of our ML models. The FLOPP-E/SLOPP-E round exhibited loss in accuracy rate with only SKNN retaining ~73% and ~49% of the correct predictions. Investigation into confounding colorants leading to accuracy loss led to the identification of copper phthalocyanine and a derivative of diketo-pyrrolo-pyrroles as potential culprits.

Poster number 34

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

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

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.

Poster number 35

Matthews, Lillian
University of North Carolina at Pembroke

Measurement and Display of the Water Quality in Select Areas of the Lumber River

The purpose of this research was to measure and display the water quality of the Lumber River by testing for nutrients, physical characteristics, and Escherichia coli. To do this we repeatedly collected samples from four selected boat ramps along the Lumber River and tested these samples using a YSI ProDSS, Hach test kits, a turbidimeter, and Colilert kits. We then projected this data onto a map using the program ArcGIS. We hypothesize that the cities, the wastewater plant, and agriculture will affect the water quality and have negative implications and that there will be a need for better water quality maintenance. We hypothesize that the cities and agriculture will create overabundant nutrients that can cause algal blooms and that the wastewater plant will cause higher amounts of E. coli and other coliform bacteria. Anoxic environments created by algal blooms could disrupt the entire ecosystem of the river and the area surrounding it. High amounts of E. coli could cause the people who use the river recreationally to get sick. Currently, our research is yet to be complete, however, we plan to create a paper on this research and present our findings to the Lumber Riverkeeper.

Poster number 36

Akabueze, Chelsea*, Smiley, Alyssa, Tang, Lucas
University of North Carolina at Greensboro, Draelos Scholars Program

BTI: Undetectable by gravid female mosquitos but highly effective against early-stage larvae

Bacillus thuringiensis Israelensis (BTI) is a soil bacterium used commercially as a mosquito larvicide. Although effective and less environmentally disruptive than traditional pesticides, it is not clear if gravid females can detect BTI in treated containers. Additionally, it is not well understood if larvae of different stages have a differential sensitivity to BTI. To investigate this knowledge gap, we conducted a field experiment using Aedes albopictus (a container breeding mosquito) as a model system, in which we evaluated the oviposition response of mosquitoes to small oviposition cups treated with BTI (crushed BTI pellets in a tea sachet) compared to control cups containing a tea sachet with sterile sand. In addition to the field experiment, we evaluated the sensitivity of three life stages: 1st-2nd instar, 3rd-4th instar, and pupae, to BTI. In the field experiment, we found that oviposition rate did not differ between cups ($P=0.81$). Meanwhile, in the sensitivity test we found that 1st-2nd instar larvae had the highest mortality rate, followed by 3rd-4th instar, while pupae were not affected. The results suggest female Aedes albopictus inability to detect the presence of BTI as well as highlighting the range of effectivity upon BTI usage, demonstrating promising implications for source reduction.

Poster number 37

Peavy, Emmett G.; Blue, Elizabeth D.
Campbell University

Quantitative Analysis of PFOA using Glassware and HPLC/MS/MS

The Cape Fear River is a highlight of eastern North Carolinian recreational and ecological activity, in addition to being a major water source for drinking water, power plants, and other industries. Unfortunately, this river has been polluted by toxic and environmentally persistent fluorinated compounds such as GenX, PFAS, and PFOAs for many decades by an industrial plant located in Fayetteville, NC and other sources. These compounds are suspected carcinogens and are theorized to cause liver damage in young children. Perfluorooctanoic acid (PFOA) and its salts continue to be used in industrial processes, in oil and water repellent coatings, surfactants, and aqueous firefighting foams. These compounds do not biodegrade easily and stay in the ecosystem for prolonged periods of time. The long-term goal of this research is to use solid phase extraction and high pressure liquid chromatography (HPLC), in tandem with mass spectrometry (MS/MS) to test river water and other samples for PFOA, PFAS, and other fluorinated compounds. The official EPA method for this analysis calls for the use of plastic measurement devices and containers, which are both wasteful and often not part of the standard equipment at most small universities. In addition, some research suggests that glassware actually adsorbs less PFOA/PFAS than plastic. As part of our research and with a goal of making the analysis of local waterways more accessible to small undergraduate institutions, this research will also investigate if glassware adsorbs PFOA and hinders the quantitative results of PFOA detection. The research presented here is the first step in this larger project and is aimed at both HPLC/MS/MS method development using our instrument and also determining if glassware is a suitable medium for measurement, storage, and analysis of these compounds.

Poster number 38

Guzman, David R.*, Julio Gonzales Gomez, Karen Guzman
Entomopixel, Grupo de Investigacion BEA, Campbell University

Development of an economical parallel-plate strain gauge sensor for measurement of small animal bite forces

Animals bite to capture prey, feed or defend themselves. Measuring animal bite-force contributes to scientific advances in the areas of physiology, anatomy, and animal behavior. This in turn increases our understanding of the ecology and evolution of organisms in relation to their specific feeding and defense adaptations. To support this type of research, instruments and methods are being developed to measure the bite-force of a variety of organisms. In this project, we designed a low-cost, miniature bite-force sensor, capable of measuring forces ranging from 10 Newtons to < 0.1 Newtons for organisms with biting mouthparts separated by < 2 mm. The design is based on a parallel-plate strain gauge assembly electrically arranged in a Wheatstone bridge configuration. The animal bite causes the plates to bend, producing an electrical signal that is proportional to the biting force. The signal is amplified and transmitted to a computer where it is recorded and displayed. The final design of the instrument has interchangeable parts to accommodate a wide range of arthropod mouth part sizes and has the capacity for dynamic ranges of 10, 1 and < 0.1 Newtons. Known weights were used for static calibration and clothes pins, or similar clips, of various sizes were used to test the repeatability and dynamic characteristics of the instrument. The capability of the instrument to measure the bite-force of live organisms was demonstrated using spiders (Pavocosa sp.) and a snake (Crotalus durissus) which showed average biting forces of 0.31 N and 9.39 N, respectively. The commonly available larvae of the Darkling beetle, Zophobas morio, also known commercially as the Superworm, was also tested. The current design provides significantly lower cost technology compared to existing instruments as well as the potential for measuring the bite-force of smaller animals than previously recorded.

Poster number 39

Butler, Ellie*, Laun, Olivia, Davis, Abby, Saunders, Cecil J, Johnson, Erik, Silver, Wayne, Rizzo, Mike
Wake Forest University (all except C Saunders), Kean University (C Saunders)

Neuropeptidergic modulation of crop-gizzard contractility in the earthworm Eisenia Hortensis

Neuropeptides are neural signaling molecules that orchestrate many vital biological functions like reproduction, feeding, and metabolism. While most neuropeptides are highly conserved throughout evolutionary history, some appear to be recently evolved in specific taxa. Studying these dynamic molecules and the genes that encode them across diverse species offers a powerful lens to study both conserved and novel aspects of neural communication. We chose to investigate neuropeptide signaling in the understudied earthworm Eisenia hortensis, the European Nightcrawler. Neuropeptide candidate genes were predicted from a neural transcriptome, and candidate neuropeptides were screened for activity using a crop-gizzard contraction assay, wherein the crop and gizzard were removed from the worm and placed in a tissue bath. Contractile activity was measured through a force transducer to assess the bioactivity of each predicted peptide. Multiple predicted peptides demonstrated ability to enhance or inhibit contractile amplitude and frequency, suggesting these gene candidates encode bona fide neuropeptides. This represents the first investigation of neuromodulation of gut contractility in Eisenia hortensis using a highly tractable and undergraduate-research friendly physiological assay.

Poster number 40

Kidimbu, Glory*, Graham, Danielle, Peralta, Ariane
East Carolina University

Nutrient enrichment effects on wetland soil bacterial traits

Soil microbiomes participate in nutrient transformations that result in bioavailable nutrients for the maintenance of global biodiversity. However, activities like land use change and industrialization modify environmental conditions in ways that influence bacterial interactions, ultimately altering microbial diversity and plant-microbe relationships. For example, nutrient enrichment from atmospheric deposition onto low nutrient but high biodiversity ecosystems are increasing. We hypothesize that this nutrient enrichment will modify species interactions between bacterial species and between bacteria and plants from cooperative to competitive ways. We test this hypothesis using soil bacterial isolated from a long-term wetland fertilization experiment (Greenville, North Carolina, USA). This ecological experiment (est. 2003) examines how nutrient additions (N-P-K fertilizer) and disturbance (by mowing) affect wetland plant and microbial community structure and function. We measured growth rates and compared antibiotic resistance trends for bacteria in the genera Bacillus and Streptomyces isolated from fertilized/mowed and unfertilized/mowed plots. Results have revealed that nutrient enrichment tends to increase soil bacterial growth rates and modify antibiotic resistance. The results from this work will help us understand how human activities that involve indirect nutrient enrichment influence wetland soil microbiomes and plant-microbe associations.

Poster number 41

Price, Ana*, Andrew P. Jacobson
Catawba College, Salisbury, NC

Is the red fox afraid of a tiger? Examining responses of native mesopredators to a variety of native and exotic scents

Over the centuries, humans have driven many apex predators such as wolves Canis lupus to extinction. The loss of top predators can cause trophic cascades, ecological impacts that ripple through, and down, the food chain. Without top-down control, one common

impact has been the release of meso (or mid-sized) predators i.e., increased populations of species such as coyotes Canis latrans, which subsequently cause impacts on other carnivores, domestic animals and native prey. In this project, we will explore how interspecific scent communication within the carnivore guild, may change the behavior of mesopredators and possibly help manage their impacts. Animal communication can take many forms, such as vocalization or scents. In many cases, communication can be both intra-specific and inter-specific, i.e., for members of their own species or other species. Scent, for instance, can communicate reproductive status of that individual to other individuals. Carnivore urine carries the 2-Phenylethylamine (2-PEA) marker and this chemical can indicate to other carnivores or prey who has been there. A 2019 study found that the use of scent marking will alter the behavior and movement of a fellow predator (Apps et al, 2019). It is speculated, then, that certain carnivore scents can be used to fool or trick, for instance, a marauding mesopredator into believing that an apex predator is present in an area and change its behavior. To investigate this, we will explore the introduction of a variety of native and non-native carnivore scents, from both apex and mesopredators, on the behavior of a native carnivores such as the red fox Vulpes vulpes.
We will collect carnivore scat from a nearby carnivore rescue center, transport it to the Fred Stanback Jr. Ecological Preserve at Catawba College, Salisbury, and examine the behavioral response of native carnivores using videos taken from camera traps.

Poster number 42

Galan Cruzes, Yahaira*, Andrew P. Jacobson, Bahy Abdelmesih
Catawba College, Salisbury, NC
The efficiency of plasma-activated water as a fertilizer compared to store-bought fertilizer
The world food supply is at risk due to a global fertilizer shortage. This shortage is caused by high demand and low supply with increasing prices of commercial fertilizers. In addition to the shortage of fertilizer, there is a need for new fertilizers that do not harm the environment. Commercial fertilizers contain nitrogen which aids in plant growth. The issue with the usage of commercial fertilizers is when the chemicals in the fertilizer are released into the environment contributing to air and water pollution through runoff. There have been alternative fertilizers such as organic fertilizers, bacteria as biofertilizers, physical methods through laser treatment, and chemical methods. The issue with these alternative fertilizers is they leave residues, contain pathogens, and do not do well with all plant species.
Plasma-activated water (PAW) is water that has been targeted with electrical discharges. PAW has been shown to improve seed germination and increase antioxidant activities even in soil with low nutrient content. PAW can produce reactive oxygen and nitrogen species (RONS) which aid in seed germination and plant growth. PAW could be used as a fertilizer and as a tool for combating the global fertilizer shortage.
The goal of this study is to determine if plasma-activated water can be used as a fertilizer to grow wheat over two months. If so, how does it compare to a commercial fertilizer? It is hypothesized that PAW would work as a fertilizer since there has been data on PAW aiding in seed germination and plant growth. The results of the experimental work are assessed according to the germination and the growth characteristics of wheat seeds. There has not been literature on such a comparison between PAW and commercial fertilizers.

Microbiology

Poster number 43

Hoffman, Mia*
Guilford College
Antibiotic properties of Cedarwood Oil
More than 2.8 million antimicrobial-resistant infections occur each year in the United States. Antimicrobial resistance is an urgent public health issue witnessed globally and we need to do what we can to prevent new resistance from developing and to stop the spread of resistance that already exists. Many plant materials such as cedarwood oil, have shown to have anti-inflammatory and antimicrobial properties. One study in particular found that Escherichia coli, Bacillus subtilis and Bacillus cereus were sensitive to cedarwood oil and showed bactericidal activity. In the current study we compared the effectiveness of steam distilled and commercially produced oil. The oil from needles and wood of a cedarwood tree were isolated by steam distillation. Antibiotic properties of the compounds were assessed in the Minimum inhibitory concentration (MIC) assay and Kirby Bauer Assay.

Poster number 44

Hamilton, Markis'*1, Ariane Peralta, Ph.D.2, and Danielle Graham, Ph.D.1
1Department of Biological and Forensic Sciences, Fayetteville State University; 2Department of Biology, East Carolina University
Impact of Nutrient Enrichment on Soil Bacterial Biofilm Formation
Bacterial traits that affect resource usage and stress response can provide a competitive advantage in a resource-limited environment. For example, biofilm formation can provide a competitive advantage and enable bacteria to adapt to many microenvironments to survive in the soil. Biofilms are a dominant lifestyle of bacterial cells in natural environments, in which sessile communities of microorganisms attach to biotic or abiotic surfaces and are embedded in an extracellular matrix. Biofilms shield bacteria from harsh environmental conditions, including variations in pH, osmotic pressure, and scarcity of nutrients. Biofilm formation can offer a competitive edge in resource-limited environments like soil and protect against environmental stresses. Therefore, we hypothesized that long-term nutrient enrichment will modulate biofilm formation in soil bacterial isolates. Biofilm formation assays were performed to examine differences between isolates from fertilized and unfertilized plots. Soil isolate strains were cultured in a 96-well microtiter

plate and grown under low nutrient culture conditions (e.g., Reasoner's 2A, R2A broth) for 1-3 days. Biofilm formation was measured via a plate reader using a standard crystal violet assay for biofilm biomass. As expected, our control, Pseudomonas putida, was able to form a robust biofilm. Compared to the positive control, some soil isolates were able to produce a biofilm; however, there was no correlation between fertilization and biofilm production. Future studies include further analyzing the phenotypic characteristics of nutrient-enriched soil bacteria to understand how nutrient enrichment influences inter- and intraspecies interactions and alters bacterial traits to enhance resource acquisition.

Poster number 45

A'lyiha Beard*, Akamu Ewunkem, Justice Brittany, Jeffery A. Meixner
Winston Salem State University
Apis mellifera
The recent past has witnessed a significant dominance of nanotechnology in every field of human life like biomedical and engineering because it is efficient, bio-friendly, safe, and economical. Among various nanoparticles, silver nanoparticles are widely accepted since they can be monitored easily by UV–Vis spectrophotometry and they exhibit anticancer, antidiabetic, antioxidant, anti-inflammatory and antimicrobial properties. Green synthesis is a simple and easily reproductible method that provides nanoparticles characterized by better stability and good dispersion in an aqueous solution. Green synthesis of silver nanoparticles from plants, microorganisms and biomaterials has recently received considerable attention. However, there are no reports on green synthesis of silver nanoparticles from honeybees. Hence, the present study focused on green synthesis of silver nanoparticles by using honeybees. Furthermore, the antibacterial activity of the biosynthesized silver nanoparticles was tested against multidrug resistant Staphylococcus aureus. The results demonstrated that silver nanoparticles synthesized by honeybees exhibited a band at 450 nm. The Scanning electron microscopy images showed particles as predominantly spherical. Furthermore, the biosynthesized silver nanoparticles were effective against S. aureus inhibiting their proliferation, and thus reducing the risk to the environment and to public health.

Poster number 46

Kyra Locklear* Sophia Hamlet* Dr. Seth O'Connor
University Of North Carolina at Pembroke
Plants in Space: Developing assays to test effects of microgravity on Arabidopsis thaliana
As interest in space flight and potential colonization grows, efforts are being made to explore the genetic mechanisms of plant growth in space. Without sending a plant to space, a clinostat can be used to simulate microgravity by slowly rotating plants. Using an AC motor rotating a 3 rpm and a continuous servo motor connected to an Arduino UNO board, tests were run using Arabidopsis thaliana (A.thaliana) seeds plated on an agar plate. To explore genetic influences on spaceflight, data from RNA-seq experiments on A.thaliana root expression in microgravity. One such gene was AGP24. Further analyses showed that AGP24 appears to be an orphan gene and while it is robustly expressed, there is no evidence it is translated into a protein. To determine if AGP24 is involved in microgravity response, guide RNAS were designed to target AGP24 using CRISPER - CAS9. In summation, this work approaches microgravity research in three ways: technologically, by creating two clinostats, bioinformatically, by analyzing RNA seq data, and molecularly by designing CRISPER guides for future cloning.

Poster number 47

Savannah, Williams*, Moore, Kayden*, Pamela Jones
Winston-Salem State University
Small rod shape morphology required for growth of E. coli at low temperature
Cellular stress occurs upon exposure of cells to an unfavorable growth condition, such as temperature changes. Physiological changes are induced to counteract the damaging effects of the stress on cellular structures and processes. A physiological change that occurs upon exposure of E. coli cells to low temperature is a transformation in morphology from rods at 37oC to small rods at low temperature. The aim of the research study is to understand the adaptive basis for the alteration in cellular shape by identifying cellular factors required to facilitate the small rod morphology and growth at low temperature. In accordance with this goal, we have identified an E. coli mutant that fails to form small rods at low temperature. In contrast to the normal growth and small rod morphology of the wild-type, incubation of the mutant at low temperature resulted in cold-sensitive growth and the formation of filamentous cells. Furthermore, introduction of a plasmid encoding the wild-type protein in the mutant resulted in normal growth accompanied by the appearance of small rods. To further determine the physiological basis for the small rod shape at low temperature, extragenic suppressors of the cold-sensitive phenotypes of the mutant were identified. The data indicate that the small rod morphology is adaptive for growth of E. coli at low temperature.

Poster number 48

Kimberlin, Cheyenne*
Lenoir-Rhyne University
Mechanical spread of microorganisms via the common feeder cockroach Blaptica dubia: A model for bacterial and viral transmission

Many different insect species are known to passively transmit pathogens, cockroaches being one of the most common to be attributed to the spread of disease and food-borne illness. Here we present a model of mechanical transmission of bacteria and a virus on the body parts of the common feeder cockroach, Blaptica dubia. Dubia roaches were allowed to walk across a bacterial lawn, of either Serratia marcescens or Micrococcus luteus, or a lawn of bacteriophage for approximately five minutes. Insects exposed to a bacterium would then be allowed to walk across a sterile nutrient agar plate for five minutes. Plates were then incubated at an appropriate temperature for 24 hrs. Bacterial colony growth indicated that transmission had occurred. Cockroaches were also allowed to walk across a sterile glass petri dish that had been swabbed with a strain of Escherichia coli-specific bacteriophage isolated from raw sewage. Insects were then moved to a nutrient agar plate overlaid with soft agar containing E. coli and allowed to walk across the plate for five minutes. Plates were incubated at 37 degrees Celsius for 24 hours or until plaques had formed. For phage plates, formation of plaques within the E. coli growth served as a visual indication that mechanical transmission of the virus had occurred. In both instances, there was evidence of successful transmission indicated by the appearance of bacterial colonies and viral plaques that followed the insect's path across the plate. Our data reaffirms past research that cockroaches can passively transmit bacteria while also presenting evidence that they can transmit viruses as well. These results have broad implications on the epidemiology of viral and bacterial disease transmission.

Poster number 49

Merrills Lydia*, Ewunkem Akamu*, Bailey Ariyon*, Priester T'nasia*, Williams Desia*, Justice Brittany*, Dinesh Singh*
Winston-Salem State University

The antimicrobial activities of three extraction solvents of reishi mushroom and their effects on ultrastructural changes of candida albican and staphylococcus aureus

The rapid rise of antimicrobial resistance is a worldwide problem. This has necessitated the need to search for new antimicrobial agents. Mushrooms are rich sources of potential antimicrobial agents. This study investigated the antimicrobial activity of ethanol extracts, aqueous extracts, and dual extract (combined ethanol and aqueous extracts) of reishi mushroom against clinical isolate of Candida albican and Staphylococcus aureus. Broth microdilution, and time-kill kinetic assays were used to determine the antimicrobial activity of the extracts against selected pathogens. Scanning electron microscopy (SEM) was used to examine the ultrastructural changes in C. candida and S. aureus induced by the extracts. Each mushroom extract exhibited antimicrobial activity against Candida albican and S. aureus after 24hr of treatment. The growth curve continuously decreased with increasing concentration of each extract. Ethanol extract exhibited the strongest antimicrobial activity. When C. candida and S. aureus were exposed to the minimum inhibitory concentration of the extracts malformed cells were observed by SEM, Morphological changes of the cells were wrinkles, shrinkage, and some deep craters noted on the cell surfaces. In contrast, the no evident signs of cell damages or morphological changes were seen in the control cells. These results suggest that extracts of reishi mushroom exhibited antimicrobial activity and may contain bioactive compounds which may serve as potential antibacterial and antifungal agents. Therefore, reishi extracts could be used to develop nutraceuticals or drugs effective against pathogenic microorganisms.

Poster number 50

Creed, Charles*, Evan Reynolds
Campbell University

Evaluation of the laccase-like multi-copper oxidase from Paenibacillus glucanolyticus for non-natural biocatalysis

Laccase-like multi-copper oxidases (LMCOs) are enzymes that carry out the oxidation of a variety of compounds with concomitant reduction of oxygen to water. They have received attention for their ability to breakdown waste products from the textile and paper industries. Given their advantages as green catalysts, these enzymes have also been explored for redox reactions outside their natural scope. We are investigating the ability of a recently discovered LMCO from Paenibacillus glucanolyticus to catalyze redox reactions not known to occur in nature. This work will provide new chemical methodologies to access valuable compounds in an efficient and environmentally friendly manner.

Poster number 51

Bailey Ariyon*, Ewunkem Akamu, Qays-Grier, Jalaa, Adjei-Fremah Sarah, Justice Brittany, Dinesh Singh
Winston Salem State University

Reishi Mushroom (Ganoderma lucidum) as Possible Antimicrobial and Antioxidant Agent

The aim of the study is to examine in-vitro antimicrobial and antioxidant activity of aqueous extract of the reishi mushroom Ganoderma lucidum. The antimicrobial activity of the aqueous extract of reishi mushroom was estimated by determination of the minimum inhibitory concentration by using broth dilution method against multidrug resistant Staphylococcus aureus and Klebsiella pneumoniae. Generally, the tested mushroom extracts had relatively strong antimicrobial activity against the tested pathogens. HPLC analysis of aqueous extract of reishi mushroom revealed three broad-spectrum antimicrobial compounds. Furthermore, the extract possessed high antioxidant capacity. In conclusion, it was suggested that aqueous extract of reishi mushroom can be used as a natural source due to its antioxidant and antimicrobial activities.

Poster number 52

Williams Zahirah*, Ewunkem Akamu, Justice Brittany
Winston-Salem State University

The "Carpenter," a Substrate for Green Synthesis: Biosynthesis and Antimicrobial potential

The scientific explorations of nanoparticles for their inherent therapeutic potencies as antimicrobial and antiviral agents due to increasing incidences of antibiotic resistance have gained more attention in recent time. This factor amongst others necessitates the search for newer and more effective antimicrobial agents. The objective of this work was to evaluate the use of insect for the biological synthesis of silver nanoparticles, and the possibility of using these nanoparticles as antimicrobial agents. We report the synthesis of silver nanoparticles from carpenter bee (Xylocopa virginica) wings extract and its antimicrobial activity. The synthesized silver nanoparticles were spherical, 20–50 nm in size and revealed strong absorption plasmon band around at 440 nm. Additionally, the antimicrobial activity results of the silver nanoparticles synthesized from the wings of carpenter bee revealed significant activity on all the tested bacteria signifying their biomedical, pharmaceutical, and agricultural potential.

Poster number 53

Priester T'nasia*, Ewunkem Akamu, Justice Brittany, Dinesh Singh
Winston-Salem State University

Mycosynthesis of nanoparticles: a potential antimicrobial agent against gram-negative bacteria

Nanotechnology is a rapidly growing field which provides various applications in biomedical and engineering with reference to biocompatibility, efficient, fast, safety and cost effective. So far, most reports on green synthesis of nanoparticles are from plants and other organisms. However, not much is known about nanoparticles synthesized from reishi mushroom (Ganoderma lucidum) a repository of rich medicinal properties. In the present study, green synthesis and cost-effective approach of silver nanoparticles using wild resihi mushrooms is reported for the first time. The biosynthesized silver nanoparticles were characterized using UV-visible spectroscopy and scanning electron microscopy studies. The synthesized silver nanoparticles were spherical, 10–30 nm in size and revealed strong absorption plasmon band around at 430 nm. Furthermore, silver nanoparticles exhibited antibacterial against Gram-negative bacteria, Salmonella typhi which signifies their biomedical potential.

Poster number 54

Spease, Lauren*, Williams, Savannah*, Pamela Jones
Winston-Salem State University

Small rod morphology required for growth of E. coli at low temperature

Cellular stress occurs upon exposure of cells to an unfavorable growth condition, such as temperature changes. Physiological changes are induced to counteract the damaging effects of the stress on cellular structures and processes. A physiological change that occurs upon exposure of E. coli cells to low temperature is a transformation of morphology from rods at 37oC to small rods at low temperature. The aim of the research study is to understand the adaptive basis for the alteration in cellular shape by identifying cellular factors required to facilitate the small rod morphology and growth at low temperature. In accordance with this goal, we have identified an E. coli mutant that fails to form small rods at low temperature. In contrast to the normal growth and small rod morphology of the wild-type, incubation of the mutant at low temperature resulted in cold-sensitive growth and the formation of filamentous cells. Furthermore, introduction of a plasmid encoding the wild-type protein in the mutant resulted in normal growth accompanied by the appearance of small rods. To further determine the physiological basis for the small rod shape at low temperature, extragenic suppressors of the cold-sensitive phenotypes of the mutant were identified. The data indicate that the small rod morphology is adaptive for growth of E. coli at low temperature.

Engineering

Poster number 55

Combs, Melinda*, Joy Harris, Debzani Deb (Faculty Advisor)
Winston-Salem State University

Image Classification using NASA Mars Curiosity Rover Image Dataset

Mars Science Laboratory (MSL) Curiosity Rover landed on August 5, 2012 and began collecting images using its three equipped cameras. This study utilized 1,552 such images captured by Curiosity rover and developed a binary image classification model that can automatically identify an image belonging to one of two classes such as "Mars", depicted by the pictures of sand, dirt, rock, surface etc. or "Rover", depicted by the pictures of rover parts such as wheel, arm, drill etc. A series of testing was done to train the computer vision model to complete our goal of identifying the difference between parts of the machine rover and the mars planetary surface. We chose to run a support vector machine (SVM) model, a version of supervised learning in which the model is given labeled data to learn from and then its algorithm will apply that to new data. We utilized Python libraries and its machine learning framework scikit-learn to develop and evaluate our model. Our evaluation results show that the model correctly identifies a "Mars" image 86% of the time and correctly identifies a "Rover" image 75% of the time.

ORAL PRESENTATIONS – Saturday April 6, 2024, Session I: 8:30-9:45 am; Session II: 10:00-11:15 am

Molecular and Cell Biology **session I – NSB 233**
8:30-8:45 am

Dietz, N. Kayla *
Lenoir-Rhyne University
The analysis of polychlorinated biphenyls in soil samples
Polychlorinated biphenyls (PCBs) are synthetic, organic compounds manufactured from 1930 to 1970.
PCBs were used for a variety of applications, including insulating fluids for transformers, sealants, and coolants. The properties of the material led to the widespread use. By 1970, PCBs were identified as a public health risk. The Environmental Protection Agency issued regulations banning the manufacture of the compound. Though PCBs were no longer produced, the use continued in existing equipment. In addition, large corporations opted to illegally dump PCB waste to evade the cost of proper disposal. The toxic and persistent nature of the molecule makes an analysis worthwhile. For this study, a Gas Chromatography (GC) method using an Electron Capture Detector (ECD) was developed. The method was validated using soil samples spiked with known amounts of a standard Aroclor. The method was then used to analyze soil samples from locations that were of interest, such as around campus or in areas that were suspected of having detectable PCB levels.

8:45-9:00 am

Dunlap, Erica*; Morris, Gunnar; and Schofield, Brett.
Wingate University
Heterodimerization of Satb1 and Satb2 is confirmed with a split YPF system.
A fundamental requirement for all living systems is the ability to regulate the activity of their genes.
This is accomplished through a variety of mechanisms including the arrangement of DNA into regions of densely packed heterochromatin - which contains silent genes - and loosely organized euchromatin - which contains active genes. This is accomplished through the use of chromatin architectural proteins such as Satb2. Expression of Satb2 is critical for osteogenesis, and has been linked to tumor progression in a variety of cancer types. Satb2 is thought to oligomerize due to its structural similarity with Satb1, which binds DNA as a tetramer. However, this similarity also gives rise to the little-explored possibility that Satb1 and Satb2 can form heterodimers. Here, we explore this possibility using a Bimolecular Fluorescence Complementation (BiFC) assay. Non-fluorescent fragments of mVenus (VN and VC) were attached to Satb1 and Satb2. Heterodimerization partially restores mVenus fluorescence. We observe fluorescence when VN-Satb1 and VC-Satb2 are coexpressed in HeLa cells which suggests that these proteins do have the ability to heterodimerize. Furthermore, fluorescence is not restored when Satb1-VN is coexpressed with VC-Satb2, which indicates that the proteins are arranged in a parallel orientation within the dimer.

9:00-9:15 am

Hirsch, Rebecca*, Xingyuan Zhang, Sunthoshini Premsankar, Hannah Lee, Lilly Chiou, Katherine Kurnit, Pierre McCrea, Russell Broaddus, Cyrus Vaziri, and Jessica Bowser
The University of North Carolina at Chapel Hill; The University of Chicago; The University of Texas MD Anderson Cancer Center
CD73 restrains mutant β-catenin oncogenic activity in endometrial cancer
Most (80%) endometrial cancers (EC) are diagnosed at an early stage and cured by surgery alone. A gap in knowledge is that 20% of these patients recur, do poorly, and biomarkers to predict recurrence are lacking. While missense mutations in exon 3 of CTNNB1 (encodes β-catenin) identify patients at higher risk, not all patients recur. We previously identified CD73 downregulation in exon 3 CTNNB1 mutant EC predicts recurrence. We reported, using a highly homologous Xenopus exon 3 β-catenin mutant, that CD73 restrains mutant β-catenin to the membrane. For this study, we interrogated patient-relevant exon 3 CTNNB1 mutation frequencies in 5 publicly available databases and developed 7 (D32N, S33F, S33Y, G34R, S37C, S37F, and S45F) myc-tagged β-catenin mutant lentiviral vectors for expression in EC cells (HEC-1-A and Ishikawa) with CRISPR-Cas9 deletion or re-expression of CD73. Reporter assays showed all patient-relevant β-catenin mutants at baseline induce transcriptional activity compared to endogenous levels. With CD73 loss, transcriptional activity for all mutants increased significantly in HEC-1-A cells (normally CD73+/+). With re-expression of CD73 in Ishikawa cells (normally CD73-/-), transcriptional activity of several but not all β-catenin mutants decreased, which provides evidence for the first time that β-catenin mutants are differentially controlled in endometrial cancer. We also performed cellular fractionations to show that loss of CD73 increases nuclear mutant β-catenin. These data suggest that loss of CD73 is a major driver of mutant β-catenin oncogenic activity in EC.

9:15-9:30 am

Campbell, Elias*; Lopez, Rubi; and Schofield, Brett
Wingate University
The Nuclear Localization Sequence of Satb2 is proximal to its N-terminus.
Eukaryotic cells regulate the expression of their genes through a variety of mechanisms including the formation of hetero- and eu-chromatin. This reorganization of DNA is accomplished by chromatin architectural proteins such as Satb2. While Satb2 is localized to the nucleus, it is not clear now the protein is transported there. Satb2 has a predicted Nuclear Localization Sequence (NLS) near its C-terminus (aa 613-616), but this sequence has never been tested for functionality. Here, we demonstrate that the predicted NLS in Satb2 is neither necessary nor sufficient for nuclear import. Instead, a region near the N-terminus (aa 21-40) is necessary for nuclear import and sufficient to direct the nuclear import of other cargo proteins such as Protein Kinase (PK).

9:30-9:45 am

M. Alayna Thompson*
Elon University
Can An Old Bird Learn New Songs? Three Promising Methods That Didn't Work.
Learning throughout life is an essential skill for humans and other animals. Based on indirect evidence, many bird researchers have concluded that mockingbirds can imitate new songs throughout life. Nevertheless, adult mockingbirds have never imitated a tutor stimulus in any experiment, perhaps because experimenters failed to create an effective social context for learning. I tutored adult mockingbirds in the field using three novel experimental methods: 1) simulating song type matching between neighbors, n=16 adults; 2) using Pavlovian methods that pair a tutor song with a food stimulus, n=4; and 3) simulating the arrival of migrant song tutors, n=19. After performing these experiments, I recorded 945 minutes of song from 28 adults and analyzed recordings by ear and through visual analysis of computer-generated spectrograms. No tutor stimuli were observed in the songs of any bird. It remains unclear how, or whether, adult mockingbirds can learn new tutor songs.

Ecology, Botany and Zoology session II – NSB 233
10:00-10:15 am

Griffith, Jerry
University of North Carolina at Pembroke
Mapping Nature's Canvas: Empowering Conservation Groups with Web-based Land Cover Analysis Tools.
As the realm of environmental conservation expands, the need for accessible tools that empower non-specialist groups becomes increasingly imperative. This paper explores the transformative impact of web-based land cover analysis tools on local land conservation organizations. Through platforms like the Multi-Resolution Landscape Consortium's Enhanced Visualization Analysis tool, NOAA's Land Cover Atlas, and the USDA's Cropland CROS, these groups gain unprecedented capabilities in assessing and monitoring land cover changes. By leveraging remote sensing data and intuitive interfaces, these tools democratize access to sophisticated analysis methods, enabling conservationists to make informed decisions swiftly and effectively. This paper examines the advantages, challenges, and real-world applications of such tools, showcasing their pivotal role in catalyzing grassroots conservation efforts. From empowering citizen scientists to facilitating evidence-based policymaking, web-based land cover analysis tools emerge as indispensable assets in the conservationist's toolkit, driving sustainable stewardship of our planet's precious resources.

10:15-10:30 am

Klein, Caroline*
Meredith College
Exploration of the Rate of Skeletonization of House Mice (Mus musculus) Using Dermestid (Dermestes maculatus) and darkling (Tenebrio obscurus) Beetles
Dermestid beetles (Dermestes maculatus) and Darkling beetles (Tenebrio obscurus) are both species of flesh eating beetles that are popular among hobbyists and museum research staff for the purpose of skeletonization. Despite their common use as an initial step in taxidermy and skeletal preparation, there was no known study that directly compared the rate of skeletonization between the two species. This study was established to offer both a quantitative and qualitative comparison between the two species as a way to determine which would be best suited for taxidermy and specimen preparation. For this study, we organized trials in which each species of beetle was assessed on the time in which they were able to skeletonize a house mouse (Mus musculus) carcass. Based on the continuous evaluation on an adapted scale and weekly weight monitoring, we demonstrated that dermestid beetles are the most efficient choice for skeletonizing specimens. However, despite their efficiency, dermestid beetles have the potential to continue to feed after skeletonization is complete. They would damage the bone tissue and in several instances, consume it. With this in mind, using the darkling beetles with smaller specimens to prevent damage would be recommended. Furthermore, the darkling beetles generally have a lower price point, making them a more accessible option for beginners and hobbyists. In conclusion, this was the first study to directly compare the two species and it demonstrates key differences in the rates of skeletonization.

10:30-10:45 am

Perry, Bethany*, Michael Stiff
Lenoir-Rhyne University, Lenoir-Rhyne University

Effects of temperature increase on circadian rhythm and stomatal development in soybeans (Glycine max)

As plants adapt to changing global temperatures, we need to understand the resulting changes in photosynthetic functions, including water and gas exchange. Circadian rhythm patterns of all life forms can alter in the face of environmental changes, including the temperature increases associated with global climate. These rhythms are 24-hour cyclic patterns of growth and activity. They influence plant physiological and developmental functions, such as stomatal aperture and leaf movement. Stomatal pores are controlled by circadian rhythms. These rhythms can be trained to a new rhythm when a variable (i.e., temperature and light) is changed. Changes in leaf behavior were quantified by measuring the amplitude of leaves and the pore opening of stomata using ImageJ software. Ten Glycine max seeds were distributed between 5 pots and placed within a Percival growth chamber programmed to the desired temperature, 28°C (control) and 33°C (experimental), and a 10-hour day, 14-hour night cycle until true leaves were developed. Then, the growth chamber was switched to a continuous light program and a 5-day timelapse was filmed. Leaf amplitude measurements were uploaded into the BioDare2 repository for analysis of circadian rhythm. Stomatal peels were then created using the fingernail polish method and wet mount slides before imaging. ImageJ software was used to measure stomatal pore diameter. ImageJ software was used to measure stomatal. Preliminary results show that plants in ambient temperature, 28°C, (control) do follow the circadian rhythm entrained by the 10-hour day, 14-hour night light cycle as revealed by leaf movement. It was found that circadian leaf movements in plants grown at 33°C deviated distinctly from those at 28°C although both were entrained by the same 10-hour day, 14-hour night light cycle. Results indicate that temperature influences patterns in leaf movement and stomatal changes.

10:45-11:00 am

Riggs, Isaac*
Lenoir-Rhyne University

The effect of smoke-water on germination and growth: a comparative study of fire-adapted and non-fire-adapted plant species

"Wildfires are an ever-occurring natural event with the potential to destroy, but over time various plant species have evolved not only to survive but to thrive under these conditions. Both the heat and the chemicals released in smoke have been shown to increase the germination rates of the seeds of some plants, especially those from chaparral ecosystems. Two such species are Matilija romneya and Nicotiana attenuate, both native to fire-prone areas of California.

This study attempted to determine whether smoke-infused water has a negative or positive effect on the overall germination and growth of plants from fire-prone areas as well as those from areas not routinely exposed to fire.

Wisconsin FastPlant™ seeds (a model plant known for rapid germination) were exposed to various concentrations of smoke-water and then monitored for seven days. Germination rates and root lengths were measured to determine the effects. Both purchased smoke water (Liquid Smoke™) as well as that produced from burning local vegetation in a bee smoker was used. FastPlants™ were inhibited at all concentrations applied and from both types of smoke-water.

To investigate whether a relationship exists between species of burned vegetation and species of affected plant, a second series of experiments was conducted. Matilija romneya and Nicotiana attenuata, both native to fire-prone areas of California, as well as Nicotianea glauca a NC native, were watered with smoke- water produced from leaves of the California oak, Quercus agrifolia, as well as from NC oaks Quercus alba and Quercus laveis. Results will help clarify the degree of specialization of smoke-induced germination in these species."

11:00-11:15 am

Sanjuan, Diego*
Lenoir-Rhyne University

Isolation and cultivation of gut bacteria from larvae of the greater wax moth (Galleria mellonella): A potential resource for bioremediation of polyethylene

According to Our World Data, about 460 trillion tons of global plastic was produced in 2019, and in 2015, 55% of the world's plastic was discarded while the rest was split between incineration and recycling. "Plastivores", organisms such as mealworms and waxworms, display unique capabilities in digesting polyethylene (PE) and polystyrene (PS) plastic, introducing bioremediation techniques to combat the growing microplastic threat. One such plastivore, the greater wax moth (Galleria mellonella), produces larvae with the unique capability to degrade and metabolize various kinds of plastics, such as PE and PS. However, the specific mechanisms responsible for PE and PS degradation in G. mellonella remain unknown, although several studies suggest bacteria and possibly larval enzymes are responsible for plastic degradation. The current study describes the isolation of various microorganisms from the gut of greater wax moth larvae that were screened for their ability to digest high-density polyethylene (HDPE). Greater wax moth larvae were weened onto HDPE by introducing a hybrid mixture of HDPE and native food. Once the larvae showed the capacity to degrade HDPE, their digestive tracts were carefully excised, macerated, suspended in phosphate buffer, and centrifuged. The supernatants containing the targeted microorganisms were inoculated into tryptic soy agar and Sabouraud dextrose agar. Isolated colonies were transferred into bottles of basal-salts media with HDPE added as the sole carbon source. These samples were incubated at 27 °C, with shaking, for 3 months. Microscopic examination of the bottle contents showed that yeast and Gram-negative bacilli were present; however, there was no visible degradation of the HDPE. Nevertheless, our results pave the way for future studies investigating the role of bacteria and wax

moth gut enzymes in the bioremediation of plastics.

Chemistry session I – NSB 225A
8:30-8:45 am

Riccardi, Abigail G.*, Mia L. Turley, Alisha M. Weinhofer, Mayra McKenna, Cole Rigsby, Dr. Brian C. Goess, Dr. Sarah K. Goforth
Campbell University, Furman University
Kinetics and mechanistic studies for Ru-catalyzed oxidation of benzyl silyl ethers
Oxidative deprotection of silyl ethers has been of interest in recent literature, and a Ru-catalyzed biphasic oxidation system has been shown to oxidize benzyl silyl ethers to a mixture of silyl esters, aldehydes, carboxylic acids, and anhydrides. A method was developed to study the kinetics of this reaction in EtOAc, and the rate of the reaction was determined to be first order. The activation energy parameters Ea, ΔG‡, ΔH‡, and ΔS‡ were determined by creating an Arrhenius plot from observed rates of benzyl silyl ether oxidations at multiple temperatures. Solvent effects on product ratios provided mechanistic insights that suggested several intermediates including hemiacetal, aldehyde, and silyl ester. One of the benzyl silyl ethers serendipitously transformed into its analogous hemiacetal. This hemiacetal as well as an aldehyde and silyl ester were each subjected to the oxidation conditions in order to compare rates and product ratios to further probe the mechanism.

8:45-9:00 am

Schulz, Erica*
Lenoir-Rhyne University
The viability and characterization of sucrose and alkali metal nitrates as solid rocket propellant
A subtype of solid rocket motors (SRM) commonly referred to as "sugars" are produced using sugar molecules as the required fuel and binder accompanied by an oxidizer. While sugar SRM formulations are primarily developed by hobbyists, little research has recently been performed in laboratory settings, especially concerning the use of oxidizers beyond potassium nitrate (KNO_3). Therefore, the purpose of this study was to produce sucrose SRM using alkali metal nitrates as the oxidizer and document their formation and burn characteristics and compare their force output data to predicted values to determine their effectiveness. Three alkali metal nitrates were chosen, beginning with KNO_3 due to its common use in sugars, followed by sodium nitrate ($NaNO_3$) and lithium nitrate ($LiNO_3$) for ease of access and similar characteristics to KNO_3. Each nitrate was combined with predetermined amounts of sucrose and water and cooked down to produce the propellant. Propellants were then molded into 32-millimeter inner diameter paper casting tubes with an 8-millimeter cylindrical core and the physical characteristics including color, ease of molding, and time taken to produce were recorded. Once cooled, the completed grains were placed in desiccators to prevent excess absorption of water from the environment prior being encased in 38-milimeter single-use motor kits. The motors were then ignited and thrust force as a function of time was collected via a student designed test stand. While some attempts were unsuccessful, viable force data collected was then run through a MATLAB program to calculate total and specific impulses and produce graphical representations of the test fire. These values were then compared to those predicted in PROPEP3 to determine percentage difference. Currently, the results of this experiment indicate that, while theoretically stronger, $LiNO_3$ and $NaNO_3$ are harder to work with and less consistent than KNO_3 sucrose SRM and therefore less effective.

9:00-9:15 am

Knight, Caleb*, Doug Knight, Bill Eichinger
Lenoir Rhyne University, Lenoir Rhyne University, Lenoir Rhyne University
Validation of force between spherical conductors
My project attempts to verify a paper that derived the electrostatic force between two conducting spheres at constant potential difference. Charge here in this scenario is not uniformly distributed and has been modeled different ways in the literature. If the paper is validated, this could provide a high precision method to measure the permittivity of free space, a fundamental constant of the universe. The best experimental technique to measure the force between two charged spheres within budget was a gravitational torsion balance. Results of calibrating the torsion balance using gravity will be presented along with measurements of force due to electrostatic charge between the spheres and how well this followed the underlying paper. A discussion on the precision needed using this technique to measure the permittivity will also be discussed.

9:15-9:30 am

Ramos,Demmi*, John Gemmer
Lenoir-Rhyne University, Wake Forest University
Investigating tipping points in the budyko climate model
The Budyko Climate Model is a dynamical system that represents the change in Earth's temperature. This model considers latitude and assumes that the Earth is only made up of ocean and ice, there are no continents or freshwater, there is no transport/advection, and the Northern and Southern hemispheres are identical. This model has three equilibrium states: stable ice, stable ocean, and bistable. Since dynamical systems can be used to make predictions about future events or behaviors of systems, it is a useful tool when analyzing forecasts of climate change. In this presentation, I will share my work exploring noise-induced tipping points to identify when we might

tip from one equilibrium to another. This was done in collaboration with the Mathematics Climate Research Network.

9:30-9:45 am

Alberto-Tenjhay, Gezell*, Fisher, Christina, Grimm, Dr. Daniel
Lenoir-Rhyne University
Analysis of cell-free extracts of endophytic fungi: the search for antibacterial metabolites
Each day, approximately seven hundred fifty thousand prescriptions are written for antibiotics worldwide. The unrelenting use of antibiotics to treat infections in humans and other animals has created multi-drug-resistant bacteria that are no longer susceptible to conventional antibiotics. This has created an urgent need to develop new antimicrobial compounds to combat the growing threat of drug-resistant bacteria. Endophytes, microorganisms that live in the interstitial spaces of plants, have been shown to exhibit antimicrobial activity against some pathogenic bacteria and represent an underexplored source of antimicrobial metabolites. Here we show that endophytic fungi extracted from leaves of selected plant species inhibit the growth of certain bacteria in the ESKAPEE group of pathogens: Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, Enterobacter aerogenes, and Enterococcus faecalis. Endophytic fungi showing partial-to-full inhibition against one or more of the bacteria tested were grown for 5-10 days in flasks containing Sabouraud dextrose broth. Biomass from each of these cultures was removed by filtration through cheesecloth and the filtrates were then centrifuged to pellet smaller particulates, including conidiospores. The supernatants were subsequently filter-sterilized, and the resulting cell-free filtrates were screened for antimicrobial activity by the streak-plating technique. Filtrates that exhibited antibacterial properties were moved forward for isolation and purification by classical chemical methods, including organic-solvent extraction and size-exclusion column chromatography. These results represent the initial steps in our laboratory for harvesting and identifying fungal metabolites capable of combating drug-resistant pathogens.

Chemistry session II– NSB 225A
10:00-10:15 am

Yakubu Faisal*, Felicia Grimes, Hassan Mohammed, Sezgin Kiren
Winston-Salem State University
Efficient synthesis of Novel Indolo[3,2-c]quinolines from 4-methoxyquinolines in two steps
Herein, we describe a practical two-step synthesis of an Indolo[3,2-c]quinoline scaffold from substituted 4-methoxyquinolines using Fischer indole method and oxidative aromatization in one-pot under Microwave radiation. With this protocol, a biologically active natural product, Isocryptolepine, and its analogues can be readily and efficiently utilized to generate a series of novel pyrrole-containing derivatives of this heterocyclic system.

10:15-10:30 am

Sain, Amy
Lenoir Rhyne University
Selenium deficiency in horses
Trace minerals are nutrients we must get from food, including chromium, copper, fluoride, iron, selenium, etc. They are necessary for not only humans but animals as well. Selenium is a trace mineral that is required by all living organisms, but the primary focus of this study is on the selenium requirements for horses. Selenium is needed for cellular function in the body of horses, immune function, and reproduction as well. The dietary requirement of selenium for horses is not greater than 0.2 ppm, but certain regions of the world have selenium-deficient soils so they may require more supplementation. A selenium deficiency can lead to a clinical syndrome known as myodegeneration or white muscle disease, a degenerative disease affecting the skeletal and cardiac muscles. Because of the low levels of selenium in soils, the preferred methods of selenium analysis are atomic absorption spectrophotometry with hydride generation, or inductively coupled plasma-mass spectrometry (ICP-MS). A newer variant of inductively coupled plasma optical emission spectrometry (ICP-OES) uses an axial view of the plasma that increases the sensitivity of the instrument. This study was the investigation of the axial view ICP-OES to determine what level of selenium could be analyzed in soil samples. For this research project, soil samples were obtained from Catawba County, North Carolina, and analyzed using a Perkin-Elmer Optima ICP-OES to establish a method for analyzing selenium content in soils using the ICP-OES. Validation of the method was performed using soil samples spiked with known concentrations of selenium. This study was able to establish a limit of detection and a limit of quantification for the ICP-OES. The limit of detection was calculated as 0.0368 mg/L and the limit of quantification obtained was 0.184 mg/L.

10:30-11:00 am

Moser, Adam* and Womick, Jordan
Campbell University
A study on the effects that aromaticity and carbon chain-length have on the thermal properties of poly(m-phenylene isophthalamide)
A polycondensation reaction using m-phenylenediamine monomer, isophthaloyl chloride monomer, and dimethylacetamide (DMAc) reaction solvent may be used to form poly(m-phenylene isophthalamide). Two variations of the m-phenylenediamine monomer were used to synthesize a polyamide with a secondary carbon positioned between the amide and a ring with either the presence or absence

of aromaticity. Differential scanning calorimetry and thermogravimetric analysis were used to thermally characterize the polymers. The glass transition temperature of the two experimental polymers was much lower than the glass transition temperature of poly(m-phenylene isophthalamide). The two experimental polymers were also found to be more soluble in water than the reference aramid. These results imply that carbon chain-length has detrimental effects on the thermal properties of meta- oriented aramids.

10:30-11:00 am

Li, Yuan*, Lloyd, Torre and Clinton, Angel
Mathematics Department, Winston Salem State University
On Diophantine equations $2^x\pm(2^k(3))^y=z^2$ and $-2^x+(2^k(3))^y=z^2$
In this paper, we solve three Diophantine equations $2^x\pm(2^k(3))^y=z^2$ and $-2^x+(2^k(3))^y=z^2$ with non-negative integer k. We obtain all the non-negative integer solutions by using elementary methods and the database of elliptic curves in ``The L-functions and modular forms database" (LMFDB).

11:00-11:15 am

Zelada-Bazán, Moisés J.*, Daniel Rabinovich
The University of North Carolina at Greensboro
Silver anticancer drugs derived from caffeine
Caffeine and theophylline are bioactive compounds that can be used as scaffolds to synthesize imidazolium salts as precursors to N-heterocyclic thione (NHT) and selone (NHSe) ligands. These sulfur- and selenium-donor ligands, and their imidazole-based analogues, have been used to prepare coordination complexes with a variety of metals, including mercury, silver, and palladium. In particular, the silver and palladium compounds have potential applications as anticancer drugs. The preparation of new silver compounds with enhanced antibacterial, antifungal or anticancer activity, and lower side effects, would be a significant outcome of the proposed work. Silver has been used in medicine to treat infections but ongoing research in transition metals attached to organic compounds shows their potential anticancer activity too. It is known that silver complexes inhibit cell reproduction by targeting thioredoxin reductase (TrxR), which is vital for cancer progression and is attractive for the design of new anticancer drugs. Moreover, the use of ligands with functionalized-caffeine that are air-stable, easily synthesized at a relatively low cost, and biocompatible, would potentially also benefit other areas of research, including the preparation of nanomaterials with interesting optoelectronic properties.

Microbiology session I – NSB 225B
8:30-8:45 am

Shaker, Jana* , Ajmal Khan, Tatiana Rincon Diaz , Loki Wirth and Marissa McDonald
University of North Carolina at Greensboro
Nanoplastics exposure alters the expression of solute carrier transporters in human aortic endothelial cells
Nanoplastics (NPLs) are tiny plastic particles (< 1 μm) that are widely found in environments such as soil, oceans, and even the atmosphere. Recent studies have found that exposure to NPLs is related to cardiovascular damage, but the underlying mechanisms remain unclear. Human aortic endothelial cells (HAECs) play a crucial role in the development and progression of atherosclerosis. Our recent study shows that HAECs can uptake NPLs in a dose-dependent manner. However, the possible pathways of endothelial NPL uptake remain unclear. In this study, HAECs were incubated with NPLs (20 μg/ml, particle size 0.07 μm) for 24 h. RNA was isolated for transcription analysis. Our results show that NPLs significantly alter the expression of several solute carrier proteins (SLC) superfamily of transporter proteins, including SLC16A6, SLC37A2, and SLC7A5 in endothelial cells. SLCs are important influx and efflux transporters in a variety of mammalian cells. This result suggests that NPL uptake by endothelial cells may occur through SLC transporters. Identifying the uptake pathways of NPLs by endothelial cells will improve our ability to assess cardiovascular risks associated with human exposure to the environmental contaminant NPLs.

8:45-9:00 am

Lutz, Summer*1, Ariane Peralta, Ph.D.2, Danielle Graham, Ph.D.1
1 Department of Biological and Forensic Sciences Fayetteville State University, Fayetteville, NC 28301 2 Department of Biology, East Carolina University, Greenville, NC 27858
Prevalence of Antibiotic Resistant Bacteria in Nutrient Enriched Soil Environments
Soil is one of the largest reservoirs of microbial diversity on Earth. Soil can also support the development of antimicrobial resistance when specific pathogens dominate and hinder organisms vital for agriculture and natural resources and also when soil biodiversity is high. Bacterial traits that affect resource usage and stress response can provide a competitive advantage in a resource-limited environment. Specifically, antibiotic resistance can provide competitive benefits and enable bacteria to adapt to many microenvironments to survive in the soil. Antibiotic resistance is a significant public health concern and understanding the prevalence of antibiotic resistance genes (ARGs) in environmental bacteria is critical to developing strategies to mitigate the spread of antibiotic resistance. We hypothesized long-term nutrient enrichment will increase antibiotic resistance in soil bacterial isolates. Leveraging a set of soil isolates from fertilized and unfertilized treatments, we tested the susceptibility or resistance of soil bacterial isolates to antibiotics such as streptomycin, penicillin, ampicillin, erythromycin, tetracycline, and chloramphenicol. Next, we genotypically screened for clinically relevant and naturally occurring antibiotic resistance genes (ARGs) utilizing PCR. Our findings revealed that all bacterial

isolates resisted two or more antimicrobial agents. However, the PCR results did not consistently associate with the phenotypic assays regarding the presence of antibiotic-resistance genes. These findings collectively indicate that soil isolates inherently harbor antibiotic resistance. Nonetheless, further investigations are warranted to ascertain the impact of changing environmental conditions on antibiotic resistance in soil bacteria.

9:00-9:15 am

Tran, Donna*
Guilford College

Momordica charantia: Testing for Antibiotic Properties

Natural products derived from plants have proven to be a source of many biologically active components, many of which are the basis of many medicines today. Extracts that are isolated from medicinal plants have been seen to have many biological activities, such as antimicrobial, anti-inflammatory, and antioxidant activities. Momordica charantia, better known as bitter melon, is a popular vegetable used in Cambodian and Vietnamese cuisine due to its many health benefits. These benefits include reducing blood sugar, having cancer-fighting properties, and decreasing cholesterol levels. The fruits and leaves of the Momordica species are rich in phytochemicals, which are chemicals found in plants to protect them against bacteria, viruses, and fungi. Although traditional medicinal practices have involved mainly ingesting the Momordica charantia fruit, the question arises as to whether any parts of the plant contain any potential antibiotic properties that could aid in the fight against antibiotic resistance. To determine this, methanol and ethanol extracts of the different parts of Momordica charantia were prepared by maceration. Extracts were tested for antibacterial activity using Kirby diffusion and Minimum Inhibitory Concentration (MIC) assays. The results of research conducted on extracts from the leaf, stem, seed, and fruit of the Momordica charantia plant to four types of bacteria: Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, and Bacillus subtilis will be presented.

9:15-9:30 am

Romero Alfaro, John*
Guilford College

Combating Antibiotic Resistance: Antibiotic Properties of Lavender and Thyme

Antibiotic resistance represents a significant crisis in public health, killing millions of people annually. Antibiotics, which revolutionized modern medicine, treating bacterial infections that were once considered fatal, are now less effective since bacteria has evolved and become resistant to these compounds. Historically, we have not always utilized antibiotics, we used things like herbs and plants to treat infections and diseases. In the search for new sources of antibiotic compounds, scientists have turned to historical records and traditional practices to identify potential candidates. Lavandula angustifolia (lavender) and Thymus vulgaris (thyme), have previously been shown to have antibiotic properties against bacteria as well as many other benefits such as being anti-inflammatory, antioxidant, anxiolytic, and antinociceptive properties. It raises the question whether natural lavender and thyme essential oil will work more effectively than commercial essential oils against gram positive and gram-negative bacteria. To approach this, extractions of both lavender and thyme using steam distillation and a rotary vamp to isolate the essential oil of the lavender flower and thyme herb. These oils were tested against Escherichia coli, gram positive bacteria, and Bacillus subtilis, gram negative bacteria, using the Kirby-Baurer method and minimum inhibitory concentration (MIC) assay to compare both types of oils. The results of these experiments from the extraction of these oil against the bacteria will be reported.

9:30-9:45 am

Fisher, Christina*, Gezell Alberto, Daniel Grimm
Lenoir-Rhyne University, Lenoir-Rhyne University, Lenoir-Rhyne University

Antimicrobial potential of fungal endophytes isolated from eight different invasive plant species of North Carolina

Human infection caused by antimicrobial resistance (AMR) in bacteria has become a growing global health issue, resulting in approximately 4.95 million deaths each year, a number that is predicted to grow to ten million per year by 2050. Despite the ever-increasing number of AMR pathogens, the annual development of new antimicrobial compounds has declined over the past four decades. The decrease in the number of FDA submissions for new antimicrobial drugs challenges us to lead the search for new antibiotics. Here we report the isolation of sixteen fungal endophytes from seven different invasive plant species that have the potential to produce antibacterial compounds effective against bacteria in the ESKAPE pathogen series. Initially, fifty-six endophytes were isolated from surface-sterilized leaves and grown on Sabouraud dextrose agar (SDA). These molds were then used in a streak plate assay, with each ESKAPE bacterium streaked in a wagon-wheel pattern around the mold growing in the center of the SDA plate. Sixteen molds inhibited the growth of one or more of the bacteria. Because the results of this initial screen may have been influenced by bacteria growing on fungal media, the process was repeated using a novel design that incorporated SDA in the middle of an agar plate surrounded by nutrient agar to support the growth of bacteria. Initial results show that four of the endophytic molds were found to produce compounds that inhibited the growth of each of the ESKAPE bacteria. Results from this project will enable us to move forward with the isolation of active biomolecules. The identification of these purified biomolecules is a key step for us in the development of novel antimicrobials.

Microbiology session II – NSB 225B
10:00-10:15 am

Ramirez Sanchez, Salma*
Lenoir-Rhyne University
Comparison of the antifungal effects of carvacrol, thymol and oregano oil on "Candida albicans"
Candida" species are the most common cause of fungal infections worldwide. Recent global reports estimate that yeasts from the genus "Candida", especially "C. albicans", are responsible for 400,000 new cases of life-threatening infections each year, with mortality rates of up to 40 - 60% in systemic candidiasis, even with antifungal treatment. Since the frequency of infections caused by multidrug-resistant yeasts is rapidly increasing, the search and development of new pharmacological strategies becomes imperative. Phytochemicals, such as essential oils (EOs), have become a potential alternative in the treatment of fungal infections. Oregano oil, derived from the herb "Origanum vulgare", is one of the most common EOs, with high antimicrobial activity attributed to its monoterpenes carvacrol and thymol. In our preliminary testing, the minimum inhibitory concentration (MIC) of a typical commercially available oregano oil was determined to be approximately 0.024%. We also compared the antifungal effects of carvacrol, thymol and three different brands of oregano oil using zone of inhibition testing. Zones of growth inhibition ranged from 0.0 – 55.0 mm diameter, with carvacrol showing the greatest anti-"Candida" activity. Additionally, chromatograms of each of the five substances were obtained by HPLC analysis, which allowed us to quantify the amount of carvacrol and thymol present in each of the EOs. These results, along with the possible correlations between carvacrol and thymol concentrations and antifungal effects will be presented.

10:15-10:30 am

Bradford, John
Durham Technical Community College
Repurposing of wastewater via microbial fuel cell technology
Background. Wastewater is one of the main waste products of the brewery industry. Approximately 3 to 10 L of wastewater is produced per L of beer consumed. While the wastewater from the brewery is usually non-toxic, its high organic content makes it highly biodegradable. Among the solid products found in wastewater, approximately 2–5 kg of spent yeast is expected for each hectoliter of beer brewed. Manipulation of the yeast in wastewater offers an affordable and environmentally friendly means of treatment while generating reusable fuel.
Project Aims. Using a microbial fuel cell, the objective of this research is to observe the electrical potential generated by the wastes from different brew processes. A microbial fuel cell (MFC), constructed by this lab, has been inoculated individually with wastewater from the preparation of two distinct brews: (1) stouts/dark beers and (2) IPA pale ales. Glucose at 1.0 M concentration was the fuel metabolized by the yeast in each sample of wastewater. To achieve peak voltage, optimum environmental conditions were established for the yeasts in each wastewater sample. The yeast from the stout/dark beer was capable of generating a maximum average potential of 440 mV over a 30-minute period before rapidly declining. By contrast, yeast from the IPA pale ale maintained a maximum potential of 120 mV for 120 minutes.
Preliminary data supports this lab's hypothesis that the particular yeast strain utilized for a given brew is key to understanding the generated electrical potential. Additionally, while still in the early proof-of-concept stage, this research indicates that MFC technology is capable of generating clean, reusable energy. In addition to wastewater treatment, it may also address issues involving sustainability, energy security and global warming.

10:30-10:45 am

Meier, Elizbeth
Durham Technical Community College
Hemagglutination by thermal oxidation of olive oil
Background. Previous work by Stone showed that mixtures of pure lipids demonstrated hemagglutinating properties towards avian erythrocytes that were like organic extracts of a wide variety of tissues. Oleic acid was a component of these mixtures. It was previously determined (Bing, et al., 1994) that micromolar quantities of oleic acid, heated aerobically to 100oC, overnight was capable of agglutinating rat erythrocytes without hemolysis. Heating was thought to induce thermal oxidation. Oleic acid – i.e.) cis-9-octadecenoic acid is an omega-9 monounsaturated fatty acid. Nutritionally, it is the major lipid in olive oil. The oleic acid content in store-bought olive oil may range from 55 to 83%, depending on the zone of production, the latitude, the climate, the variety, and the stage of maturity of the olives.
Project Aims. The primary objective of the proposed research is to determine the potential of olive oil to act as an agglutinating agent. First, store-bought olive oils will be obtained to evaluate their degree of unsaturation based on the iodine number. The olive oils with the highest unsaturation levels will undergo thermal oxidation via microwaves and they will be used to perform agglutination assays via previously established methods (Bing, et al., 1994). While oleic acid is not the only fatty acid in olive oil, its percentage by mass in olive oil may be as high as 85%. The hypothesis of this lab is that olive oils with a higher oleic acid content may also act as hemagglutinins, but with a possibly higher titer. Based on results, oils with comparable amounts of oleic acid and similar chemical compositions to olive oil will also be investigated for their potential activity as a hemagglutinin.

10:45-11:00 am

Van Staalduinen, Lynn*, Daniel Grimm
Lenoir-Rhyne University/Lenoir-Rhyne University

Role of EPS-degrading substances in phage-based strategies of biofilm disruption in enteric pathogens

Klebsiella pneumoniae and Escherichia coli are two common strains of bacteria that cause serious infections. Traditionally, bacterial infections are treated with antibiotics, which are not always effective due to improper usage or development of bacterial resistance. An alternative method of treatment is the targeted introduction of bacteriophages: viruses that specifically target and kill a certain bacterial strain. While both antibiotics and bacteriophages are effective in eliminating living bacteria, neither is capable of fully eradicating bacterial biofilms. Biofilms consist of living bacteria embedding in a matrix of secreted biomolecules. The extra polymeric substance (EPS) matrix helps the microbes "stick" to the surface of what they are growing on and protects the living bacteria from environmental stressors, making the infections more difficult to treat. Many enteric pathogens form such biofilms. There is no current treatment method that simultaneously targets the bacteria and the EPS of a biofilm-forming bacterial infection. While various substances can break down the EPS, most are not highly effective against the living bacteria. This experiment tests the effectiveness of a combinatorial method of treatment for biofilm-forming bacterial infections by applying various combinations of bacteriophage and EPS-degrading substances to the biofilm, with relevant controls for each combination. Results will give us more information about the usefulness of a combination of bacteriophages with EPS-degrading substances as a more complete eradication method for biofilm-forming bacterial infections.

11:00-11:15 am

Holland, Noah*, Gideon Wasserberg, Loganathan Ponnusamy
University of North Carolina Greensboro, University of North Carolina Greensboro, North Carolina State University

Preliminary Observations of Geographical, Habitat, and Seasonal Preferences of North Carolina Chiggers

Chiggers are common ectoparasitic mites in North Carolina that attack vertebrates, including humans. In the US, chiggers have not been considered as vectors for disease, and are primarily considered nuisances. Yet, in South-Eastern Asia, chiggers have been documented as vectors for the disease "Scrub Typhus", a potentially deadly disease caused by the bacteria Orientia tsutsugamushi. However recently, and for the first time anywhere in the US, our group identified Orientia tsutsugamushi in chigger mites collected in NC. To characterize geographic and seasonal risk factors to human health more ecological research is needed. To evaluate this, we sample chiggers in six sites across NC (Mountains: Lake James, South Mountains. Piedmont: Kerr Lake, Falls Lake. Coast: Merchants Millpond, Dismal Swamp) in three different habitats (forest, forest edge, field). Chiggers were collected using the tile method at 10-meter intervals, along five 100-meter transects, within each habitat in each site. By exploring the variations between sites, between habitats within sites, and over time, as well as evaluating Orientia infection rates, we will identify high risk areas and times for chiggers and possible disease across the state. To date, we've found three chigger species known to attack humans Eutrombicula cinnabaris, Eutrombicula lipovskyana, and Eutrombicula splendens. Processing and analysis of our samples and data is still ongoing. However, based on our preliminary data analysis, chiggers prefer habitats in wooded areas (overall average chigger incidence rate of 0.14±0.021, 0.11±0.015, and 0.014±0.0033 in forest, forest edge, and field habitats respectively). Peak activity seems to be in mid-Summer, with highest average incidence rate 0.31±0.066 in July for forest habitats, 0.22±0.070 in August for forest edge habitats, and 0.020±0.014 in August for field habitats. Testing for Orientia bacteria infection and calculating abundance in collected chiggers is still ongoing.

College Advisory Board Overview

Overall Description:

The College Advisory Council (hereinafter, "CAB") will advise the Winston-Salem City Council regarding matters that are of interest to students who are enrolled in colleges and universities in Winston-Salem which, in turn, will encourage the retention of college graduates in Winston-Salem.

Mission Statement:

The CAB serves as a body that represents the needs, interests, and concerns of college students and recent college graduates by engaging them in relevant community projects, programs, and issues.

Composition:

The CAB will be comprised of students who are enrolled in colleges and universities in Winston-Salem. The students will be nominated by:

1. The representative college and university;
2. Other interested young adult-oriented organizations and agencies.

Purpose:

The purpose of the CAB is to serve as an advisory council to the City Council regarding areas of City services, such as economic development, transit, and housing issues (and other issues the group may suggest), that will encourage students to remain in Winston-Salem post-graduation.

Goals/Objectives:

1. To suggest and contribute ideas to economic development projects that will appeal to college students and young professionals;
2. To advocate for public transit availability and accessibility at various colleges and universities;
3. To voice concerns and resources pertaining to off-campus student housing issues involving landlords, property managers, and fair housing matters;
4. To actively engage in learning about community leadership opportunities that will encourage and foster partnerships with colleges and universities as well as young professionals.
5. To encourage college students to remain in Winston-Salem after graduation.

Administration:

The CAB will be administered by the Human Relations Department. In this capacity, the Human Relations Department shall be authorized to: supervise the programs and activities of the CAB; consider all recommendations of the CAB; determine feasibility, appropriateness, compatibility with the city's core services and mission, and budgetary restrictions when considering the recommendations of the CAB; and communicate with respective schools regarding any inappropriate and/or unbecoming conduct, or illegal behavior that rises to the level of necessitating the correction or removal of any member of the CAB.

Process of Selection:

The CAB will consist of twelve (12) members and twelve (12) alternates who are enrolled as full-time college or university students in Winston-Salem. Two students and two alternates will be nominated by each college or university, the Leadership Quad, or any other interested college student-oriented agencies or organizations. Each school will be asked to select students who are diverse in terms of race, national origin, gender, interests, academics, and socio-economic status. This information is to be included on the supplemental application to be screened by the Human Relations Department. Four students' names for each school will be sent to the Mayor's Office by the Human Relations Department. The Mayor will recommend student members to the City Council for appointment.

Members of the CAB will hold office for a one-year term and until their successors are appointed and qualified; however, members may serve for more than one (1) term. Appointments will be made to coincide with the academic calendar in order to facilitate greatest student involvement.

The CAB will elect its own chairperson, vice-chairperson, and secretary who will serve for one year. Should the chairperson be absent at any meeting, the vice-chairperson will preside over the meeting. Should the chairperson and vice-chairperson be absent at any meeting, the CAB will elect a temporary chairperson from among the secretary and/or other members to preside over the meeting.

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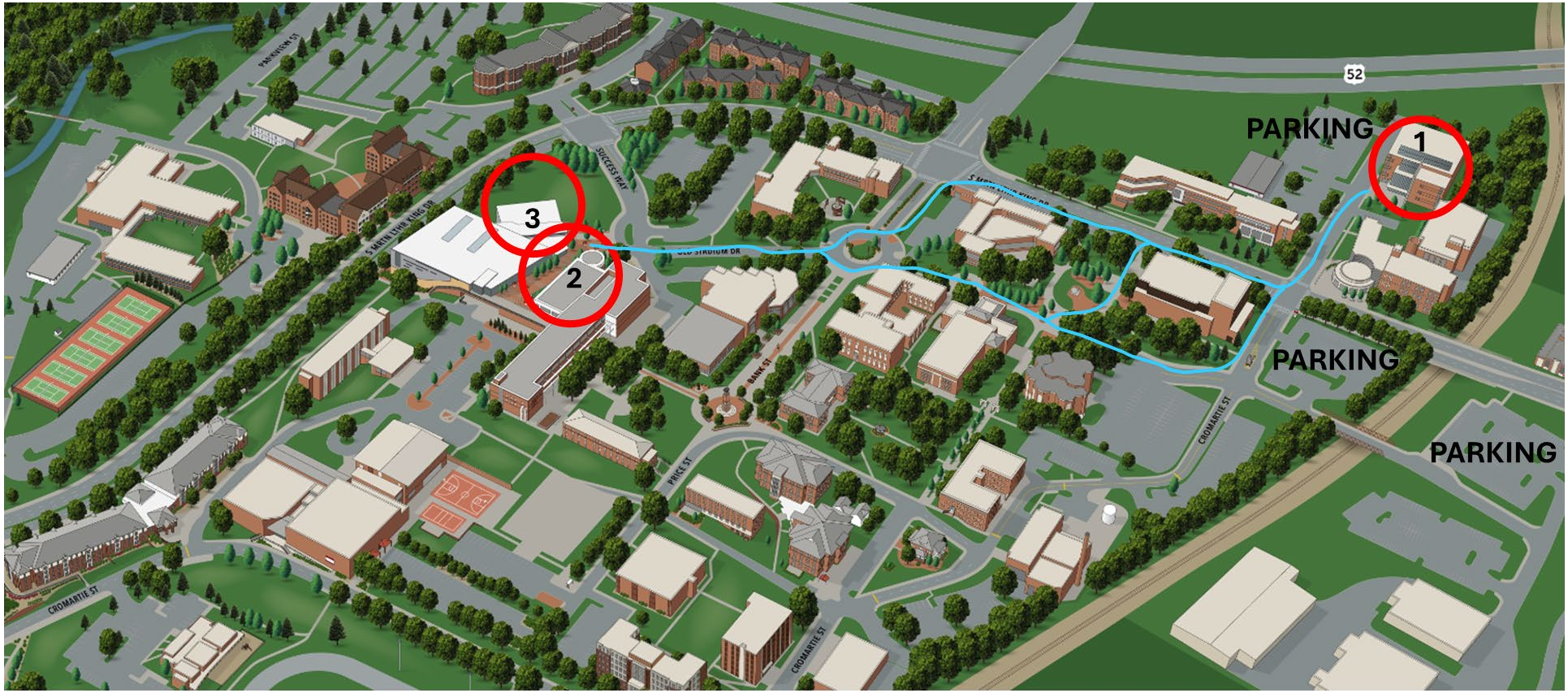

1 = New Science Building (NSB)
2 = Kennedy Dining Hall
3 = Donald J. Reeves Building (DJR)

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