SIGMA XI

THE SCIENTIFIC RESEARCH SOCIETY

2026

Northeastern Regional Research Conference

Saturday April 18, 2026

WESTERN CONNECTICUT STATE UNIVERSITY

Hosted by the Western Connecticut State University Sigma-Xi Chapter

Acknowledgments

Western Connecticut State University

SIGMA XI
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WESTERN CONNECTICUT STATE UNIVERSITY

April 18, 2026

Dear Colleagues, Students, and Friends,

The WCSU Sigma Xi Chapter welcomes you to the 2026 Northeastern Regional Research Conference at Western Connecticut State University, Danbury, Connecticut, for a day of collegiality and conversation. It is here that we can identify local talent, and work together to forge new ideas, and apply interdisciplinary solutions to global problems.

The Planning Committee has worked hard to assure that today will be a day to celebrate scientific research in all fields and at all levels, and the importance of engaging the next generation of researchers in an ethical and unbiased fashion – two pillars of Sigma-Xi's core foundation. Sigma Xi is the honor society of many Nobel Prize Winners, and today we hope that a future winner may be inspired by their experience here and through the support of Sigma Xi mentorship.

Welcome to Danbury, and thank you for supporting Sigma Xi and the scientific enterprise!

Sigma Xi is the honor society of research scientists and engineers. It is an international multidisciplinary group whose programs and activities promote the health of the scientific enterprise, reward excellence in scientific research and encourage a sense of companionship and cooperation among scientists in all fields. For more information please visit https://www.sigmaxi.org/.

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SCHEDULE

8 AM – Arrival and Check-in at **Student Center Lobby.**.Judging instructions provided to registered judges. Judge's Room: Student Center 228

8-8:30 AM - ** Continental Breakfast Served at **Student Center. Attendees should use this time to hang posters.

8:45 AM – Welcome Address by **President Jesse Bernal**. – in **Student Center Theather**
9 AM- Welcome Northeast Sigma Xi Chapters. Delivered by Sigma Xi President Dr. Daniel I. Rubenstein, Princeton University. *"The Interdisciplinary Nature of Research."* - in **Student Center Theater**

9:15-10 AM – Opening Keynote Presentation**: Dr. Dustin Rubenstein,** Sigma XI Distinguished Lecturer, Thomas Hunt Morgan Professor of Conservation Biology, Columbia University. – *"Cooperation in a Changing World"* –in **Student Center Theater**

10:15 AM-11:15 AM - Poster Session and Judging – **Student Center Judges Room – 226 Student Center**

11:30 AM – 12:15 PM – Box Lunch at **Student Center**

12:15-12:55 PM – Keynote Presentation: **Dr. Matthew Tracy**, Associate Professor of Chemistry, University of Pittsburgh Johnstown and the 2025 Rudy Ruggles Interdisciplinary Research Award winner – *"Preparation and Biological Evaluation of Amide-Containing Quorum Sensing Inhibitors"* – in **Student Center Theater**

1-2 PM – Continuation of Poster Session and Judging – in **Student Center Judges Room – 226 Student Center**

2:30 PM – Remarks Jamie Vernon, Executive Director, Sigma Xi- in **Student Center Theater**
2:45 PM Keynote Presentation: **Dr. Katerina Trepekli,** Environmental Scientist. WSCU Visiting Scholar and 2025 Fulbright Candidate - *"Applying Deep Learning and Remote Sensing Observations in Building Community Resilience"* in **Student Center Theater**

3:45 PM – Award Presentation and Closing Remarks – in **Student Center Theater**

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Our keynote Speakers:

9:15 AM – **Dr. Dustin Rubenstein,** - *"Cooperation in a Changing World"*

12:15 PM - **Dr. Matthew Tracy**, – *"Preparation and Biological Evaluation of Amide-Containing Quorum Sensing Inhibitors"* –

2:45 PM – **Dr. Katerina Trepekli,** - *"Applying Deep Learning and Remote Sensing Observations in Building Community Resilience"*

Dr. Dustin Rubenstein

Dustin Rubenstein is a Professor of Ecology, Evolution and Environmental Biology at Columbia University in the City of New York. At Columbia, he is the Director of the Center for Integrative
Animal Behavior and Chair of the University Seminar in the Integrative Study of Animal Behavior.
As an innovative leader in undergraduate education, Rubenstein helped create the Program in Tropical Biology and Sustainability, a semester-long study abroad program in Africa, and the sTEAM Fellows Program, a team-based interdisciplinary summer research program for first year students from underrepresented groups.
Rubenstein received his A.B. from Dartmouth College in 1999 where he was a Reynolds Scholar following graduation, and his Ph.D. from Cornell University in 2006 as a Howard Hughes Medical Institute Predoctoral Fellow in Biological Sciences. He was then awarded a Miller Research Fellowship to conduct postdoctoral work at the University of California, Berkeley from 2006-2009.
His research takes an integrative approach to understand why complex animal societies form and how organisms cope with environmental change through studies that combine behavior, ecology, and evolution with those of the underlying molecular and neuroendocrine mechanisms. He has studied a variety of animals, including reptiles, birds, mammals, crustaceans, and insects in Central and South America, Asia, Australia and Africa. Rubenstein is the author of over 100 publications, as well as co-editor of the book *Comparative Social Evolution* and co-author of the market-leading textbook *Animal Behavior*.

Dr. Matthew Tracy

Dr. Matthew Tracy is an Associate Professor in Chemistry at the University of Pittsburgh Johnstown. He is the 2025 Rudy Ruggles Research Award winner for his project "Preparation and Biological Evaluation of Amide-Containing Quorum Sensing Inhibitors" together with biologist Dr. Henning at the same institution.

The interdisciplinary proposal is meant to advance chemical synthesis and infectious disease research against multi-drug-resistant bacteria by designing new therapeutics that can target quorum sensing by using amidation and the subsequent biological activity testing.

Dr. Tracy received his B. Sc. From Fordham University and his PhD. From the University of Pittsburgh

Dr. Katerina Trepekli

Dr Katerina Trepekli is an Environmental Scientist and Civil Engineer with extensive international research and professional experience in technology, energy, and environmental management, with a focus on resilience to climate risks.

Katerina holds a PhD in Environmental Engineering, along with two Master's degrees in Hydraulic Engineering and Structural Engineering. During her postdoctoral career, she served as a scientific lead for the development and implementation of research programs, and worked as a lecturer and researcher at leading academic institutions (University of Copenhagen, Columbia University, University of Vienna, Lund University).

Dr. Trepekli' s academic work has focused on the development and application of innovative remote sensing technologies, machine learning, and computational tools, as well as the design and implementation of field experiments (in Greece, Denmark, Sweden, Switzerland, Greenland, Guatemala, and Ghana) for monitoring, assessing, and optimizing energy and environmental systems.

Leveraging her research experience on the impacts of weather extremes, Dr. Trepekli serves as a Scientific Advisor to the Minister of Climate Crisis and Civil Protection in Greece, contributing to the development of strategies linking civil protection with adaptation to climate related risks, as well as to reforms aimed at strengthening the country's resilience to natural hazards. She is also appointed responsible for the development and implementation of innovative digital projects, such as the National Database of Risks, Disasters, and Losses, which utilizes artificial intelligence technologies to improve decision-making.

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Please Join The WCSU Sigma Xi Chapter in Honoring

Dr. Pamela Kerrigan is a biochemist, educator, and long-serving academic leader whose career spans more than three decades at the University of Mount Saint Vincent. She earned degrees in chemistry and biology from Lakeland College, an M.S. from the University of Wisconsin–Milwaukee, and a Ph.D. in bioorganic chemistry from Arizona State University. A dedicated member of Sigma Xi since 1995, she has served the society in numerous leadership roles, including Director for both the Northeast Region and the Baccalaureate Colleges constituency, two terms on the Executive Committee, and was honored with the Evan Ferguson Volunteer Award in 2020.

At Mount Saint Vincent, Dr. Kerrigan has taught organic chemistry and biochemistry for 32 years and serves as Assistant Dean of the School of Natural and Mathematical Sciences. She founded the college's Sigma Xi chapter and has led research on porphyrins for photodynamic cancer therapy. She is also a long-time co-author of the *Barron's AP Chemistry* review book and a reader for the AP Chemistry exam.

Her professional service includes leadership within the American Chemical Society as Chair, Secretary, and Councilor of the New York Section, co-chair of the 45th MARM, and recognition as an ACS Fellow and recipient of the 2025 Outstanding Service Award. She has been principal investigator on multiple major grants, including NSF S-STEM, MSEIP, and HSI IUSE.

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Organizing Committee

Theodora Pinou, Ph.D. Planning Committee Co-Chair, Biology Department WCSU

Bernard Gee, Ph.D. Planning Committee Co-Chair,Psychology Department WCSU

Helena Prieto, Ph.D. Planning Committee Co-Chair, Chemistry and Biochemistry Department WCSU

Paula Philbrick, Ph.D. Ecology & Evolutionary Biology, U. Connecticut

Gary Lessor, Director of the WCSU Meteorological Station

Hannah Reynolds, Biology Department WCSU

Zachary Popkin-Hall, Biology Department WCSU

Nick Greco, Chemistry and Biochemistry Department WCSU

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Behavioral Sciences

Poster 1

The Effects of Neurodevelopmental Lead Exposure on the Formation of Prefrontal Cortical Neural Networks

Stephanie Velez[1,2], Camryn Friedberg[1,2], Sabrina Johnson[1,2], Nayeli Vicioso[1,2], Aisha Hameed[1,2], Abel Monichan[1,2], & Lorenz S. Neuwirth, Ph.D.[2,3]

[1]Department of Biological Sciences, SUNY Old Westbury, Old Westbury, NY
[2]SUNY Neuroscience Research Institute, SUNY Old Westbury, Old Westbury, NY
[3]Department of Psychology, SUNY Old Westbury, Old Westbury, NY

The environment continues to expose developing children to the neurotoxicant lead. As a result, children are inadvertently exposed to an environmental contaminant that causes persistent brain damage. Here we employed the rat model to simulate what happens in the brain of Control (untreated) compared to Early Postnatal (EPN;lead treated) rat pups at postnatal days (PND) 2, 7, 14, and 22. The purpose of the study was to provide evidence that early neurodevelopmental exposure to low-lead levels (i.e., 150 ppm in the drinking water) can cause significant alteration in the prefrontal cortical synapse formation and connections. The prefrontal cortical neurons in both layers 2/3 (i.e., GABAergic for inhibition) and layers 4/5 (i.e., sensory relays and integration) were examined through a commercial Golgi stain and quantified using the National Institutes of Health (NIH) ImageJ software for Scholl analyses. The preliminary data only from PND 7 rats were used to determine differences the branching of apical and basal dendrites and the number of intersections observed from the layer 2/3 and 4/5 pyramidal neurons, cortical disorganization with less neurons, truncated apical and basal dendrites, and aberrant neuronal migration patterns. which may be due to failed pruning in early neural develop and resulting in too many neurons remaining contributing to sensory processing disorders of hyper-communication.

Poster 2

The Effects of Neurodevelopmental Lead Exposure on Skull Formation, Fontanelles Morphology, and XRF-Elemental Analyses

Benjamin Durisile[1,2] David Mabruki[1,2,] & Lorenz S. Neuwirth, Ph.D.[2,3]

[1]Department of Biological Sciences, SUNY Old Westbury, Old Westbury, NY
[2]SUNY Neuroscience Research Institute, SUNY Old Westbury, Old Westbury, NY
[3]Department of Psychology, SUNY Old Westbury, Old Westbury, NY

The environment continues to expose developing children to the neurotoxicant lead. As a result, children are inadvertently exposed to an environmental contaminant that causes persistent brain damage. Here we employed the rat model to simulate what happens in the skull formation, fontanelles morphology, and XRF-elemental analyses of calcium and lead in Control (untreated) compared to Early Postnatal (EPN; lead treated) and Perinatal (PERI; lead treated) rat offspring at postnatal days (PND) 2, 7, 14, and 22. The purpose of the study was to provide evidence that early neurodevelopmental exposure to low-lead levels (i.e., 150 ppm in the drinking water) can cause significant alteration in the skull formations of EPN PERI rats compared to Control rats using 3D volumetric surface plots. Further, the fontanelles of the lead treated rats had differing morphologies relative to control. Additionally, we are currently collecting XRF data to evaluate the mineral and metal deposits particularly for both calcium and lead across all age points assessed and only PND 2 were fontanelle formations detected and developmentally delayed. The data currently suggest that the early exposure to lead, regardless of EPN or PERI exposures can cause cortical bone malformations, delays in closure of the fontanelles, and morphological changes that may constrain brain volume ontogenetically.

Poster 3

Trust, Media, and Organized Crime: A Case Study of Perception in Morales, Guatemala

Alisson España*, Dr. Hasan T. Arslan, PhD

Western Connecticut State University, Danbury CT

This exploratory research examines how organized crime is portrayed by local media and perceived by residents in Morales, Izabal, Guatemala, a small urban community that has been overlooked in criminological research. While much of the existing literature focuses on large metropolitan areas, this research addresses the gap in understanding how crime is perceived in smaller, localized communities. Using a **quantitative survey distributed via gatekeepers on social media platforms,** data were collected from residents aged 18 years old and older to assess their primary sources of crime-related information and their levels of trust in those sources. Preliminary findings suggest that residents rely more heavily on **social media and interpersonal communication** than on traditional news outlets, primarily due to **distrust in formal institutions and law enforcement**. Although earlier phases of the research included interviews with journalists, the current analysis focuses solely on survey results. These findings offer important insights into the **role of media, trust, and informal communication networks** in shaping public perceptions of organized crime in non-metropolitan settings.

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Computer Sciences, Engineering and Applied Math

Poster 4

An Agentic AI Framework for Histopathological Breast Cancer Detection Using Wavelet Multi-View Learning and Spatial Transcriptomics

Nikita Sufia Karim* Dr. Xiaodi Wang, Dr. Yongzhao Zhao

Department of Mathematics and Computer Science Artificial Intelligence Program
Western Connecticut State University, Danbury, CT

This research presents an agentic AI framework for precise breast cancer subtype classification that integrates histopathology imaging, wavelet-based feature extraction, and spatial transcriptomic profiles. Histopathology data are processed using a wavelet-enhanced convolutional neural network to extract discriminative multiscale image features. The wavelet operation is formulated as a linear transformation$y = Wx$, where $W \in Rn \bullet n$is an orthonormal Daubechies-db4 discrete wavelet transform matrix constructed from scaling and wavelet filter coefficients. Gene expression matrices are projected into reduced spaces using Principal Component Analysis (PCA) as an orthogonal projection, Singular Value Decomposition (SVD) as an optimal rank-kkk approximation with error bound $||X - Xk||F = \sigma k+1$, and Nonnegative Matrix Factorization (NMF) as an additive basis decomposition $X \approx WH$. An agentic system autonomously selects the dominant modality by evaluating reconstruction error and classification variance across factorized subspaces. This mathematically optimized approach improves numerical stability, reduces dimensionality from $O(n3)$to $O(k2n)$, and enhances diagnostic precision for invasive ductal carcinoma. These results demonstrate how applied linear algebra directly advances computational oncology.

Poster 5

Characterization of Bacteriorhodopsin-based Thin Films

Phillip Sgobba*, Emma Maselli*, Trent Brown*, Issac Macwan, Krishna Dixit

Fairfield University, CT

Retinal degeneration causes loss of light-sensing cells, creating a need for materials that convert light into electrical signals for artificial retina devices. This project investigated bacteriorhodopsin (BR) based multilayer thin films as a light-responsive coating, examining how fabrication influences their structure and function. Layer-by-layer assembly forms the BR films, enabling the study of the relationship between layer number and performance. Dacron is used as a substrate for Scanning Electron Microscope (SEM), electrochemical impedance spectroscopy (EIS), and photocurrent testing due to its flexible, porous structure relevant to implant design. While mica is used as a substrate under Atomic Force Microscopy (AFM) for its smooth surface, enabling clearer nanoscale imaging of BR patches. Dynamic mode on the Naiosurf NAI AFM examines surface topography, measures height changes as layers increase, and provides insight into the film growth. SEM assesses surface morphology, and elemental analysis verifies protein deposition. ImageJ quantifies pore coverage across different layer counts to determine how effectively the BR film fills the Dacron scaffold. EIS evaluates interfacial charge transport, while photocurrent testing determines whether the films generate a measurable light-driven electrical response. Together, these methods connect film structure with device performance.

Poster 6

Exploration Into Hypoxia-Associated Genes in the Pulmonary Artery of Mus musculus

Grace C. Karangekis, Dr. Ana Estrada

Department of Biomedical Engineering, School of Engineering and Computing, Fairfield University, CT

Mouse models are a key experimental tool for examining many biomedical abnormalities, such as the impact of hypoxia on the pulmonary artery. We were specifically interested in how hypoxia altered the genetic pathways and subsequent remodeling of the pulmonary artery in the mouse, Mus musculus. The purpose of this study was to research the interactions between 560 different hypoxia-associated genes from the pulmonary artery of Mus musculus with a primary focus on incorporating key genes, specifically Vascular Endothelial Growth Factor (Vegf) into the Netflux database to implement new pathways into the cell network model based on our findings from the relevant genes.

While many genes contribute to altered signaling due to hypoxia in Mus musculus, the exploration into the relationship between the gene pathways of each hypoxia gene is very valuable, especially in the context of vascular growth and remodeling.

With an increased focus on the way in which specific genes have been expressed in the cardiovascular system, the vascular endothelial growth factor, Vegf emerged as particularly important for pulmonary artery remodeling. While Vegf is essential for normal vascular development, this signaling cascade has been identified as a key pathway for hypoxia-induced remodeling that should be incorporated into our cell signaling network model. Further development was investigated by exploring Vegf into computational modeling to simulate the responses of the smooth muscle cell in the pulmonary artery of Mus musculus.

Poster 7

Computational Modeling of Hypoxia in Vascular and Pulmonary Artery Smooth Muscle Cells

Erin Gibbons, Dr. Ana Estrada

Fairfield University

Pulmonary artery growth and remodeling is driven by excessive proliferation of smooth muscle cells. Vascular smooth muscle cells (VSMCs) in the pulmonary artery wall and pulmonary artery smooth muscle cells (PASMCs) control the diameter of the pulmonary artery consequently changing the pulmonary vascular resistance (PVR). A high PVR indicates pulmonary hypertension: a condition where blood pressure rises in the pulmonary arteries, often due to hypoxia. Hypoxia causes arteries to thicken and narrow, making it difficult for blood to flow to the lungs while also putting a strain on the heart. This condition also leads to an increased level of certain peptide hormones and proteins. A complex VSMC network model is used to investigate the effects of hypoxia on vascular remodeling by adding new pathways and simulating different perturbations: increased angiotensin II, stress, Notch, PRR, FAT atypical cadherin 1 (FAT1), and IL-R. With this framework, we further demonstrated the role of hypoxia on vascular remodeling by incorporating new species to better simulate hypoxia and further analyze the effects of increased peptide hormones and proteins.

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Interdisciplinary Research

Poster 8

Metabolomics reveals diet and health profiles of steppe pastoralists along the ancient Silk Road

Tianrui Zhu[a], Alsu Ibrahimli[b], Christopher Lawrence De Jesus[c], Thomas A. Neubert[c], Sirojiddin J. Mirzaakhmedov[d], Husniddin Rakhmonov[d], Shujing Wang[e], Timothy Bromage[f]

[a] Institute for the Study of the Ancient World, New York University, USA, [b] Hunter College, USA
[c] Department of Neuroscience and Physiology, NYU Grossman School of Medicine, USA, [d] Samarkand Archaeological Institute, Cultural Heritage Agency of the Republic of Uzbekistan, Samarkand, Uzbekistan, [e] School of Archaeology and Museology, Peking University, P.R.China, [f] Department of Anthropology, New York University, USA

Latest research has found that metabolites derived from endogenous biological functions and disease and from exogenous sources such as food and infectious diseases become trapped in nanoscopic niches in bone as it develops. It has been shown that ancient metabolites can be recovered from archaeological bones and be mapped to the specific ancient food sources and diseases.
This poster presents a pilot study on untargeted metabolomics of the osteological remains from two 3rd-6th centuries CE individuals, who were buried in kurgans (burial mounds) located on the edge of the Bukhara Oasis in southern Uzbekistan. This region in antiquity supported an important Silk Road city, Bukhara, as well as steppe pastoralists. While traditionally individuals buried in the ancient kurgans are assumed to be nomadic pastoralists, our metabolomics study reveals that they were potentially consuming large amounts of cultivated grapes. Also figuring prominently in their metabolomic profiles are markers for wild celery, licorice, and honey, foods that are typically invisible in the archaeological record. We have also found indicators of inflammation. These findings demonstrate the exciting potential of archaeometabolomics for characterizing ancient diets and diseases. This poster also presents our analytical pipeline as well as the current challenges of this work.

Poster 9

GIS Analysis of Targeted Invasive Plant Inventory Data from Bashakill and Tivoli Bays Wildlife Management Areas

Emily Kinney

Department of Biology, Western Connecticut State University

Invasive species have been shown to be one of the major drivers of global biodiversity reduction. To achieve management goals, data is needed to predict invasive emergence, risk assessment, vector management, and targeted management work. I collected data during an invasive plant species inventory in the field with a handheld GPS monitor May to August of 2025. Using (GIS) technology, I conducted a spatial analysis with targeted invasive plant inventory data within two WMAs to identify which site types had more invasive species and where the highest density of invasives were located. One hundred and seventeen locations along human access points were noted as having invasive plants in Bashakill and Tivole Bays WMAs. There were significant differences between the number of species between off-trail and trail ($p=0.001$) sites and off-trail sites and parking areas ($p=0.013$) in Bashakill WMA. Parking areas at both sites had the highest mean number of invasive plant species, and off-trail locations had the lowest mean. There was no significant correlation between density and the number of species in Bashakill, and only a weak correlation in Tivoli. The results of this study may be useful for informing future management work.

Poster 10

Deicing Salt Application Causes Deadly Spike in Roadside Soil Salinity.

Shanelle Akoto*, Elizabeth Barreto*, Shanely Lemuz* , Dr. Brian Haney

University of Mount Saint Vincent

As urban areas expand, and winter storms become more unpredictable and severe, city and state governments are increasingly relying on the application of deicing salt to roadways in order to mitigate hazardous driving conditions. There has been significant research attention given to the consequences of this salt application on freshwater ecosystems, but surprisingly little given to the potential consequences to the roadside soil communities. Healthy soil is rich in micro-invertebrates that play an important role in nutrient cycling. Salt contamination may reduce the soil micro-invertebrate population to the point that nutrient cycling would be slowed, thus reducing plant productivity and the health of the entire ecosystem. In order to assess this possibility, we measured the salt contamination levels of roadside and pavement side soil from various urban locations throughout the winter and spring seasons. We also collected uncontaminated soil, visually assessed the abundance of micro-invertebrates, and experimentally treated the soil with varying amounts of salt to determine the level that causes mortality. We found that roadside soil can contain salt levels that trigger micro-invertebrate mortality after winter storms, but this contamination is transient and quickly drops to safe levels after moderate springtime precipitation.

Poster 11

Bridging Criminal Justice and Computer Science: The S.H.O.T. AI Database on Officer-Involved Shootings

Hasan T. Arslan*, PhD , Shahab Band, PhD

Justice and Law Administration Department and Computer Science Department, Western Connecticut State University

The S.H.O.T. (Statistics Help Officer Training) AI Database Project is an interdisciplinary research initiative designed to advance scholarly understanding of officer-involved shootings and the deadly use of force in the United States from 2000 to the present. The project brings together faculty and students from **criminal justice and computer science** to address persistent data gaps and analytical limitations in the study of police use of force. Drawing on systematically collected open-source records, the database captures detailed incident-level, demographic, situational, and institutional variables, enabling rigorous empirical analysis across time and geography.

A defining feature of the S.H.O.T. project is the integration of **large language models (LLMs)** into data management and analysis. Collaboration between criminal justice scholars and computer science researchers supports the development of AI-assisted tools that enhance coding reliability, extract structured information from unstructured narratives, and facilitate advanced qualitative–quantitative analyses. Students actively participate in data collection, validation, and model development, gaining hands-on experience at the intersection of justice studies, data science, and artificial intelligence.

By combining substantive expertise in policing research with technical innovation in AI and database design, the S.H.O.T. project advances evidence-based, interdisciplinary scholarship on police use of deadly force.

Poster 12

Normative Construction of Crime and Victimization

Dr. Divya Sharma

Justice and Law Administration, Western Connecticut State University

This paper examines the construction of normative dialogues and framing funnel about crime and victimization in Western media and academia. It focuses on two distinct topics: one, the Citizenship (Amendment) Act (CAA), 2019 (India), and two, Khalistani terrorism and its sympathizers in Western countries. The CAA fast-tracked Indian citizenship for religious minorities persecuted in Afghanistan, Bangladesh, and Pakistan. The Western media, activists, and academics framed it as an anti-Muslim law, largely dismissing the persecution of religious minorities in these countries. Khalistani terrorists killed tens of thousands of Hindus and Sikhs in the 1980s and 1990s in Punjab, India. Many extremists got political asylum in the West, from where they continued to fund and carry out acts of terrorism, including the Kanishka bombing, the worst act of aviation terrorism until the 9/11 terrorist attacks. Portrayal of both topics in Western media and academia shows selective moral revulsion and classification of crime and victimization based on political framing, media access, and power relations. It creates a hierarchy of which victims are given visibility and which perpetrators are held accountable, thus reflecting the contested nature of crime and victimization, putting a micro-minority immigrant group at even higher risk of hate and violence.

Poster 13

Why Research Excellence Depends on Cross-Functional Rigor in Early R&D

Pawankumar Suresh*

Summit Therapeutics, CA

Scientific excellence in biopharmaceutical research depends not only on discovery, but also on whether data are traceable, methods are disciplined, and technical decisions remain interpretable as programs advance. In many organizations, regulatory readiness is viewed mainly as a late-stage submission concern. In practice, it begins much earlier and requires coordination across analytical development, quality, manufacturing, program leadership, and scientific communication.

Drawing from experience across analytical development, quality control, CMC, regulatory project management, and cross-functional execution in biopharma, this poster examines why regulatory readiness should be understood as a research-excellence principle rather than a downstream compliance exercise. It will highlight how documentation rigor, analytical reproducibility, governance discipline, and clear communication strengthen product understanding, reduce avoidable ambiguity, and improve decision-making throughout development.

As research becomes more complex and collaborative, scientific quality increasingly depends on the systems and habits that allow results to be trusted, interpreted, and translated into action. Regulatory readiness, viewed this way, is an interdisciplinary framework for sustaining research excellence.

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Life Sciences

Poster 14

Nighttime Peripheral Autonomic Sympathetic Arousals and Their Relationship to Insomnia in Humans

Samuel Reine,* Keona Matsui*, Alfonso Romero*, Ryan Sharky*, Neil Kavey, Ana Ribeiro

University of Mount Saint Vincent

Arousals occur throughout the night, occasionally resulting in full-fledge awakenings. Arousals can be measured at the cortical level, and also observed in peripheral tissues resulting from changes in sympathetic autonomic tone. Variations in the number and timing of arousal could be indicative of underlying sleep disorders. Studying the number and distribution of peripheral arousals could lead to treatments for conditions of hypo or hyperarousal. Seventy human subjects were recruited [males and females, ages 19-68, insomnia severity index (ISI) scores 0–26]. Peripheral autonomic sympathetic arousals were recorded during the night using Watch-PAT (Itamar). Changes in peripheral autonomic tone were recorded as peripheral autonomic tone index (PAI) 15-50, representing a decrease in 15-50%, respectively, in blood vessel diameter.

Number of PAI events (all intensities) increased after sleep onset until 1AM, then decreased slightly, and had their highest levels at 4AM. Comparing insomniacs to normals revealed that the number of arousals is elevated in insomniacs, and the sleep-stage distribution is different. Subjects with no insomnia showed low PAI values across all sleep stages, and strong stage differentiation. In contrast, subjects with high ISI scores had elevated PAI levels across all stages, flattened stage differences and high variability, indicating unstable autonomic regulation.

Poster 15

From Variant to Repair: Investigating and Correcting a Rare Pathogenic GDF11 Mutation.

Sean T. Congdon, John Bennett, **Rhoddean Opinya***, Amara R. Agosto, **Olivia Dossias***, Christopher Kokko, Aime A. Levesque, Andrew O. Koob, Adam C. Silver, Cindy A. Thomas-Charles

University of Hartford, CT

Rare genetic diseases collectively affect more than 300 million people worldwide, creating a growing global genetic disease crisis in which most conditions remain undiagnosed or lack effective treatments. A substantial fraction of these disorders arise from single-nucleotide mutations that disrupt protein production, including nonsense variants that introduce Pre-mature Termination Codons (PTCs) . Despite rapid advances in genome engineering, scalable strategies for precisely modeling and correcting pathogenic variants remain limited. Here, we used CRISPR Prime Editing to model and repair a de novo GDF11 nonsense mutation (Tyr336*) identified in a participant in the Undiagnosed Diseases Network (UDN) presenting with growth delay and multisystem abnormalities. Heterozygous HEK293T clones carrying the mutation exhibited reduced GDF11 protein levels consistent with haploinsufficiency, Golgi fragmentation, and widespread transcriptomic dysregulation paralleling features observed in the patient. Optimized PE7-based prime editing, combined with a Pridict-designed pegRNA and a silent PAM-disrupting mutation, enabled efficient correction of the pathogenic allele. These findings position prime editing as a powerful platform for functional interrogation and allele-specific repair of disease variants, illustrating how programmable genome editing can help address the broader global burden of rare genetic diseases.

Poster 16

Studies toward the development of potent and selective pyruvate carboxylase (PC) inhibitors

Zakir Hossain[1] , Subhabrata Chaudhury[1], Nick Schneider[2], William A. Donaldson[3], Martin St. Maurice[2]

[1]Department of Biological and Chemical Sciences, New York Institute of Technology
[2]Department of Biological Sciences, Marquette University
[3]Department of Chemistry, Marquette University

Pyruvate carboxylase (PC) is a biotin-dependent mitochondrial enzyme that catalyzes the ATP-driven conversion of pyruvate to oxaloacetate (OAA), a key intermediate that replenishes the tricarboxylic acid (TCA) cycle. Elevated PC activity supports cancer cell growth by enhancing anaplerosis and metabolic flexibility. Studies using siRNA knockdown in MDA-MB-231 breast cancer cells demonstrate that reducing PC expression decreases proliferation, migration, and invasion. Dysregulated PC has also been linked to non–small cell lung, thyroid, colorectal, and pancreatic cancers. Beyond its role in cancer, PC contributes to glucose homeostasis through OAA production for gluconeogenesis, making it a promising therapeutic target for metabolic diseases such as type 2 diabetes.
Despite PC's biological importance, few potent and selective small-molecule inhibitors exist. We recently identified 1,3-disubstituted imidazolidinetriones (IZTs) as a promising new scaffold. Several IZTs show low-micromolar potency in biochemical assays and display strong selectivity, lacking inhibition of representative metalloenzymes such as carbonic anhydrase II and matrix metalloproteinase-12. Compared with previously reported α-hydroxycinnamic acid inhibitors, IZTs demonstrate improved cell permeability while maintaining comparable potency and enhanced selectivity. This work outlines our biochemical characterization of IZTs as selective PC inhibitors and highlights their potential as chemical probes for cancer metabolism and as leads for therapeutic development.

Poster 17

Spatial Analysis of Pollinator Pathway Conservation Efforts in Danbury through GIS.

Christa Piccorelli

Western Connecticut State University

The Pollinator Pathway emerged in 2017 as a citizen conservation effort to reduce habitat segmentation in urban and suburban area by planting native flora to keep native fauna populations alive. As urban sprawl, deforestation, and agriculture grow, native populations of North American invertebrate pollinators are on the decline (Cane and Tepedino 2001). To combat this, the Pollinator Pathway aims to plant native flora gardens within 750 meters of each other and nature preserves. Native pollinators such as bombus terrestris, typically have a varying flight range with 200 m on average but can exceed 1 km (Wolf and Moritz 2008). Non-profit, citizen run organizations operate by the limitations of their members and do not use spatial data to determine the next location of a pollinator pathway garden.

Poster 18

Water as a Common Good: Monitoring the Quality of our Local Watersheds

Al-Warith Mallick*, Diana Garcia Melgar

SUNY Old Westbury, NY

Water is a vital yet increasingly vulnerable resource, and local water bodies face growing threats from contamination and scarcity. As part of the Water as a Common Good (WCG) project at SUNY Old Westbury, we are monitoring the water quality and microbial communities of the Town of Hempstead Watershed. Over the past year, we sampled 17 sites across five locations, including two in a freshwater stream draining into Wantagh Bay. At each site, we measured temperature, salinity, dissolved oxygen, ammonia, nitrate, pH, and turbidity. Water was filtered through 0.22-micrometer membranes and DNA was extracted using a Qiagen PowerWater Kit. Sequencing of 16S rRNA barcodes and analysis with QIIME2 revealed highly site-specific microbial communities. Alpha diversity was generally high across all sites, while beta diversity ordination showed distinct clustering by location, indicating that local environmental factors shape community composition. A notable outlier was the FCCP location, which displayed highly variable alpha diversity and uneven bacterial abundance distributions. One FCCP site showed a distinct taxonomic profile, with approximately 71% of sequences belonging to Proteobacteria, Bacteroidota, and Cyanobacteria, compared to 82% at other sites. These findings establish a baseline for long-term monitoring and provide a framework for detecting future environmental impacts on this vital watershed.

Poster 19

Airborne Fungal Exposure in Indoor Environments: ITS-Based Profiling to Investigate Environmental Drivers of Cancer-Related Health Disparities

Ericka Esther*, Peace Bolaji*, Mowaffaq Adam Ahmed Adam

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Fungal contamination in indoor environments is an underrecognized environmental health concern that may disproportionately affect underserved communities, where delayed remediation and chronic exposure are more common. Some fungal strains produce secondary metabolites (mycotoxins) that are associated with DNA damage, mutagenesis, and other cellular changes linked to long-term disease risk, including cancer. This project examines airborne fungal exposure as part of a broader effort to understand environmental contributors to cancer disparities. In the current phase of this study, air-exposed sampling materials were collected using HEPA filter units, and removable filters were swabbed for fungal biomass collection. To preserve sample integrity and prevent cross-contamination, samples were collected directly into cryo-collection tubes at each site and processed immediately after collection. Fungal DNA is being isolated using a fungal DNA isolation kit, followed by ITS-based fungal identification using the Oxford Nanopore Microbial Amplicon Barcoding Kit 24 V14. Sequencing data will be analyzed using QIIME2 View to profile fungal diversity and compare community composition across sampling locations. As this project is currently in the early stages of data generation and analysis, final results are not yet available. We anticipate identifying distinct fungal profiles across indoor environments, including potentially high-risk taxa associated with poorly ventilated or moisture-damaged spaces. This work will help build a student-generated environmental fungal exposure dataset and support future studies examining how chronic fungal exposure may contribute to cancer-related health disparities in vulnerable communities.

Poster 20

A Student-Led Pipeline for Environmental Fungal Risk Screening: ITS Identification, Toxin Watchlisting, and Data Standardization

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Indoor fungal contamination is an underrecognized environmental health concern that may contribute to long-term disease risk, particularly in communities where mold remediation is delayed or incomplete. Certain fungal genera can produce secondary metabolites (mycotoxins) with known or suspected roles in DNA damage, mutation, and other cellular changes linked to carcinogenesis. This project is part of an ongoing environmental health research effort focused on building an early-stage pipeline to identify fungal exposure risks with potential relevance to cancer disparities.

In this initial phase, environmental fungal samples are being processed for ITS-based identification using the **Oxford Nanopore Microbial Amplicon Barcoding Kit 24 V14**. Sequencing outputs are being analyzed and visualized through **QIIME2 View** to support taxonomic classification of fungal genera present in collected samples. Following identification, a structured literature-guided screening workflow is being used to flag genera with known or suspected mycotoxin-producing potential and organize them into a prioritized toxin watchlist for future mechanistic study. In parallel, a standardized data brief framework is being developed to improve how taxonomic outputs, annotations, and preliminary interpretations are organized and communicated across student projects.

Because this work is in its early stage, no final results are reported yet. We anticipate identifying multiple environmentally relevant fungal genera, including candidates associated with mycotoxin production, and establishing a reproducible workflow that supports future studies on genotoxicity, epigenetic disruption, and cancer-related exposure risk in vulnerable communities.

Poster 21

Analyzing historical environmental data to evaluate climate change in Connecticut

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Over the past century, climate change has significantly impacted global weather patterns, leading to shifts in temperature, precipitation, and other climate variables. In this study, we examined climate change on a fine scale within Connecticut, focusing on how key climate variables have changed over time. Using NOAA climate data (1920–2023), we analyzed trends in variables including temperature, precipitation, and snowfall. We focused on changes in spring climate variables. Spring climate is important because spring represents a critical time in the phenology of natural populations, as this is a period of germination and emergence for many species. The analysis revealed variation across the climate variables. Temperature in particular has increased significantly since 1970. These shifts in climate variables have implications for local biotic communities, affecting species distribution, phenology, and ecosystem dynamics. Understanding these changes is crucial for developing effective conservation and management strategies in response to challenges brought by climate change.

Poster 22

Early Cellular Stress Responses to Aflatoxin B1 and Ochratoxin A in H1299 Cells: Implications for Toxicity and Cancer Risk

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Fungal secondary metabolites such as **Aflatoxin B1 (AFB1)** and **Ochratoxin A (OTA)** are major environmental toxicants with known or suspected roles in promoting cellular damage and increasing cancer risk. This project investigates how exposure to these mycotoxins affects **cell viability** and **oxidative stress** in **H1299 cells**, with a focus on early cellular responses that may contribute to long-term disease development.
H1299 cells will be treated with **AFB1** and **OTA** at different concentrations under controlled culture conditions. Cellular viability will be measured using a **plate-based viability assay** to evaluate dose-dependent toxic effects. In parallel, **reactive oxygen species (ROS)** generation will be assessed using **MitoSOX staining**, followed by fluorescence readout through **live-cell imaging** to monitor mitochondrial oxidative stress. Together, these methods will allow us to compare the cytotoxic and oxidative effects of each toxin and identify early stress patterns linked to toxin exposure.
This project is currently in the **experimental setup and data collection phase**, so final results are not yet available. We anticipate that both toxins will reduce cell viability and increase ROS levels in a concentration-dependent manner, with possible differences in toxicity profiles between AFB1 and OTA. These findings are expected to support ongoing efforts to better understand how environmental fungal toxicants contribute to cellular injury and may increase cancer risk, particularly in communities with higher exposure burden.

Poster 23

The Short-Term Effect of Salinity on Soil Organic Carbon in Pond Sediment

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Runoff of road salts poses concerns of lower diversity, lower biomass, and changes in the makeup of freshwater communities near roadways. We hoped to answer how salinity affects the percent soil organic carbon (%SOC) in pond sediment over time. To test this, we ran three experiments 1) measured monthly %SOC between September and December, 2) measured %SOC in pond sediment exposed to salt solutions over a 14-day period using microsocms, and 3) repeated the second experiment but extended the timeline to six weeks. We found that monthly %SOC varies, with an increase between September and October, followed by a sharp decrease, and a slow increase. The %SOC change between each month was statistically significant from each other ($p<0.05$), except September and December. Over a 14-day period, there was no significant effect of NaCl concentration, however over a six-week period, time, NaCl concentration, low salt, and light significantly decreased %SOC, and light x day significantly increased %SOC ($p<0.05$). However, the effect of day x concentration was not significant ($p>0.05$). These results show that the month sampled affects the outcome, due to significant changes in the %SOC. This study fills a knowledge gap of how lower salinity levels affect %SOC over time.

Poster 24

Structural Identification of Amino Acid Mutations in the *Plasmodium falciparum* DHFR Quadruple Mutant and Comparative Analysis with Trypanosoma brucei DHFR

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Drug resistance in Plasmodium falciparum is largely driven by mutations in the dihydrofolate reductase (pfDHFR) gene that reduce the activity of antifolate drugs such as pyrimethamine and cycloguanil. This study examines the structural and functional impact of the pfDHFR quadruple mutant containing four substitutions: N51I, C59R, S108N, and I164L. Structural analysis revealed that these mutations are within or near the active site, altering inhibitor binding while preserving enzymatic activity. The S108N substitution introduces a bulkier residue that creates steric hindrance, directly decreasing antifolate binding. While the N51I and C59R further reshape and stabilize the active site environment, and the I164L induces additional conformational adjustments that contribute to the highlevel of resistance.

Comparative analysis with wild type dihydrofolate reductase from Trypanosoma brucei demonstrated notable similarities in active site architecture, including conserved residues and a functionally equivalent bulky residue at position 108. These structural equivalences help explain the intrinsic antifolate resistance of T. brucei and suggest similar adaptations that limit drug interaction. Overall, these findings provide a structural framework for developing next-generation antifolates capable of overcoming the resistance in malaria parasites.

Poster 25

The Progressive Digging task: a naturalistic assay of effort-based food motivation in mice

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The progressive ratio (PR) task is a widely used measure of effort-based food motivation, but it relies on operant conditioning rather than natural behaviors. Here, we developed a progressive digging (PD) task that leverages the natural foraging behavior of mice to assess food motivation. In the PD task, mice retrieve a buried food reward by digging through progressively deeper layers of bedding, and the total amount of bedding displaced across trials serves as the primary measure of effort. We validated the PD task by testing the same male C57BL/6N mice under fed and fasted conditions in both PD and PR tasks. Effort was stable across repeated fed (baseline) testing for both tasks, indicating consistent performance. Baseline effort in the PD task showed a moderate, non-significant correlation with baseline effort in the PR task. Following a 12-h fast, effort significantly increased in both tasks. Importantly, the magnitude of this increase was greater in the PD task than in the PR task, indicating enhanced sensitivity to motivational state. Together, these findings demonstrate that the PD task is a reliable and more sensitive measure of effort-based food motivation that complements the PR task and may improve detection of motivational changes in preclinical studies.

Poster 26

Differentially Expressed Genes Involved in NF-κB Inhibition in Cancer Cells in Response to Curaxin

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Curaxin (CBL0137) is a small molecule with anti-cancer activity observed through inhibition of FACT complex, simultaneous activation of p53, and inhibition of NF-κB. In our previous reports, we analyzed differentially expressed genes (DEGs) from three datasets of CBL0137 treatment in glioma (GSE153441), cervical (GSE117611) and multiple myeloma (GSE117611) cells and found seven hub genes that potentially activate p53 in these cells. In order to identify DEGs with potential role in NF-κB inhibition, in this study we examined recently available transcriptomic data from the GEO dataset GSE223327, derived from the fibrosarcoma cell line HT-1080 treated with 0.5 μM CBL0137, along with the three previously analyzed datasets. The DEGs were identified based on -log10(p-value) > 1.3, and log2FC > 1 and < -1, and analyzed using GEO2R, Enrichr, STRING and Tableau. CBL0137 treatment in HT-1080 cells resulted in 39 upregulated and 86 downregulated genes compared with the control. Furthermore, 43 genes were common DEGs in any three of the four datasets, while two genes, BTG2 and IFIT2 were common DEGs to all four datasets. Enrichr analysis showed that BTG2 and IFIT2 are elements of the TNF-alpha signaling pathway via NF-κB, suggesting the potential involvement of additional regulatory pathways.

Poster 27

Advancing Phage Structural Biology Through High-Resolution Resin Printing

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This project investigates the utility of resin printing for creating complex biological models where conventional fused deposition modeling (FDM) may have unrealistic print time overhead, use complex supports and use large amounts of waste filaments. SUNY Old Westbury biology majors in the SEA-PHAGES program isolate and characterize novel bacteriophages from soil samples. Among the genes of interest in these phages are structural proteins that make up the capsid and the tail of the phage. While 3D printing these proteins has already been done, resin printing has not been evaluated as of yet. Resin printing is superior to FDM in their dimensional accuracy and surface resolution. This fidelity makes resin-printed models especially valuable for creating structures with great interior complexity or generally large surface details, such as proteins such as the Subaru_GP17 tailtip cage, amongst other proteins that we will be evaluating. This project will conduct a systematic evaluation of resin and FDM outputs across a defined set of phage structural proteins from phages isolated by SEA-PHAGES students, assessing dimensional accuracy, surface finish, workflow complexity, and safety burden. Findings are intended to provide evidence-based guidance for usage of complex biological models in research based settings while maintaining proper safety protocols.

Poster 28

Multi-Agent Artificial Intelligence Framework for Monitoring Personalized Health (MAAIF-Health)

Ayush Kar*, Bibhuprasad Mahakud

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Self-monitoring of health information has become easier with the use of smartwatches and mobile health applications, providing valuable insights for taking timely health actions. However, data are often scattered across hospital records, wearable devices, and diet logs, leaving much information underutilized in clinical decision-making due to the lack of an integrated analysis framework.
We evaluated a multi-agent AI framework based on retrieval-augmented generation (RAG) to utilize these distributed data sources. The AI-based agent generates a concise overview of patient health for physicians. The health agent assesses the risk of 20 medical conditions, while the nutrition agent detects trends in 15 potential nutritional deficiencies.
Our prototype was tested on 30 patient profiles, which contained over 500 clinical reports and 100,000 timestamped entries across 100 variables. Doctors rated the generated outputs 4.5 out of 5 on average, indicating the system presents health conditions more clearly than patient descriptions.
Future work will validate the framework with larger datasets and integrate it into clinical workflows for personalized, preventive healthcare.

Poster 29

Effects of Pollen and Sugar Supplementation on Bumblebee Size and Virus Dynamics

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Pollinator health is increasingly threatened by environmental stressors, with pathogen transmission from managed honey bees to wild bee populations emerging as a significant concern. Bumblebees play a critical ecological role as pollinators in both natural and agricultural systems, yet they are vulnerable to viral infections that may spread through shared floral resources. This study investigated whether nutritional supplementation influences individual body size in bumblebees (Bombus terrestris) and the dynamics of two key viral pathogens: Bombus densovirus (BDV) and Black queen cell virus (BQCV). Using a factorial BACI (Before–After Control–Impact) design, sentinel colonies were supplemented with sugar solution, pollen, both, or neither. Colonies were monitored throughout the study period to assess changes in individual bee size and the prevalence of BDV and BQCV over time. The results demonstrated that BDV was detected at high levels at the start of the study and increased over the course of the experiment, while BQCV prevalence varied among colonies. Nutritional supplementation with sugar, pollen, or both showed no consistent effect on bee size or viral prevalence. These findings suggest that in florally rich environments, supplemental feeding may not significantly influence bee size or the infection dynamics of BDV and BQCV in bumblebee colonies.

Poster 30

Exploration of parasite host selection of Varroa destructor on Apis mellifera

Anwen Burwick*[1], Dale Wong*[2], Pierre Vallet[3], Amélie Noël[3], Joachim de Miranda[3], Torrance Hanley[4], Alyssa Woronik[4], and Barbara Locke Grandér[3].

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Varroa mites (Varroa destructor) are an invasive external parasite of the honeybee (Apis mellifera) and a vector of multiple viruses, potentially resulting in increased occurrence of colony mortality. Varroa resistance traits have been found in certain populations of honeybees, which could offer an alternative to chemical treatment in Varroa mitigation and improved colony health. Resistant (RES) bees have demonstrated differences in pheromone production and timing relative to non-resistant, susceptible (SUS) colonies. However, it is not fully understood how Varroa-resistance contributes to Varroa infestation of colonies. This study investigates whether bees originating from a mite-resistant colony and the associated pheromone differences influence mite host preference. To do this, mites were place in prototyped y-mazes with RES larvae and SUS at either one of the two terminal chambers. After three hours, the mites were removed, and their choice of larvae was recorded. This study gives some insight into how differences in the resistance status of a colony effect Varroa mite behavior.

Poster 31

Determining the Impact of Beekeeping Management on Honey Bee Welfare

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Past literature on animal welfare has primarily focused on traditional livestock and companion animals, often to the detriment of insects. Emerging research has found that insect welfare has a profound impact on agriculture, human health, and environmental health. However, the intensity of beekeeping management, in particular, varroa mite treatment, on oxidative stress in honey bee colonies is undetermined. To address this question, we established an experimental pilot to measure oxidative stress in colonies exposed to varying intensities of beekeeping management. We performed a thematic analysis on 4 focus groups to determine how beekeepers' attitudes influence beekeeping and bee welfare. Then we sampled 16 honey bee colonies across 4 sites in the Uppsala region. We preserved our samples in a temperature of -20C and measured the varroa mite count per sample. Our results indicate that Lövsta has a greater mean of mites per bee compared to the other sites. In the summer, we will measure oxidative stress per colony using PCR and qPCR. We aim to determine whether the intensity of treatment increases oxidative stress and its effect on the lifespan of managed bees. Our pilot has implications for the impact of beekeeping on oxidative stress and honey bee welfare.

Poster 32

Identifying olfactory processing differences between mite-susceptible and Suppressed Mite Reproduction (SMR) honey bee colonies using Proboscis Extension Reflex (PER) conditioning

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Parasitic, virus-carrying Varroa destructor mites represent a major threat to global Western honey bee (Apis mellifera) colonies. The period just prior to brood capping has been identified as a critical period for infestation due to mite perception of brood ester pheromones (BEP) emitted to stimulate capping behavior in nurse bees. According to recent research on BEP profile composition in populations exhibiting Suppressed Mite Reproduction (SMR), a trait known to reduce mite reproductive success, lower BEP signaling levels may contribute to resistance. However, it remains unclear whether worker bees from resistant colonies perceive or process capping-associated olfactory cues differently than bees from susceptible colonies. We have employed Proboscis Extension Reflex (PER) conditioning to investigate potential differences in olfactory perception and associative learning between SMR and susceptible honey bee colonies through training nurse bees with contrasting mite susceptibility to associate standard BEP and a synthetic BEP lacking compounds involved in capping behavior with a sucrose reward. Quantified learning acquisition and response rates across conditioning trials demonstrate higher average response and retention rates of SMR bees to stimuli. By strengthening the understanding of varied behavioral responses to BEP cues, this study aims to clarify natural virus defense mechanisms in honey bees.

Poster 33

Comparing oyster health and parasite communities between aquaculture grow-out methods and among sites

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Oyster aquaculture provides a variety of valuable ecosystem services and is a critical component of sustainable seafood production in the United States. Oyster aquaculture uses multiple farming techniques, such as on-bottom cages and floating bags, to optimize oyster condition and marketability. These different methods expose oysters to a variety of abiotic and biotic factors that can independently and interactively affect oyster health metrics. In particular, the relationship between grow-out methods and parasite exposure, and the consequent effects on oyster vital rates, merit further investigation. Here, we compared survival, growth, and condition of oysters grown on-bottom vs floating at four aquaculture sites in Massachusetts from July to December in 2023 and 2024. We also measured prevalence and intensity of five common oyster micro- and macro- parasites. We found that oysters grown in on-bottom cages had consistently lower survival, decreased growth, and worse condition than oysters grown in floating bags, though the magnitude of these differences varied across aquacultures sites. In addition, parasite community prevalence consistently differed between on-bottom cages and floating bags within sites, but the magnitude of this difference varied across sites. Our findings inform practice by highlighting how variation in parasite communities affects oyster health depending on farming methods.

Poster 34

Assessing the effects of sediment conditioning on seagrass seed germination and seedling performance

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Seagrass meadows provide numerous ecosystem functions and services, making restoration of these ecologically-valuable systems a high priority for coastal managers. The global decline of seagrass meadows necessitates finding consistently effective restoration methods. Recently, there has been increased interest in seed-based methods of seagrass restoration. However, these methods have had mixed success, with highly variable outcomes. Relatively little is known about how sediment characteristics, including soil conditioning by seagrasses at different spatial and temporal scales, may affect seed germination and seedling success in a restoration context. To examine the effects of seed source and sediment characteristics, we conducted a laboratory experiment using eelgrass seeds collected from different source meadows and comparing i) sediment collected different distances from a natural meadow (0-250 m from the edge) and ii) sediment that varied in historical seagrass presence (seagrass present currently and seagrass present 1-20 years ago). We measured seed germination and seedling performance, and also assessed seed quality and viability. Our results can be used to inform seagrass restoration in New England, suggesting that i) sourcing seeds from multiple meadows will increase the likelihood of including higher quality seeds, and ii) including sediment inoculations from vegetated sites may increase success.

Poster 35

How Do Excess Phosphates Affect the Diversity of Aquatic Microbiomes?

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Water pollution is a serious problem that continues to harm our environment in ways that are easy to overlook. Phosphates, chemicals that come from sources like fertilizers, soaps, and other industries, are a major concern. While small amounts of phosphorus occur naturally and are actually necessary for life, too much of it may cause major algal blooms and major ecosystem disturbance. Our research question is, does high phosphate concentration in water impact microplankton diversity? To answer this, water samples were collected from local sites in Wantagh Park, New York, as a baseline. The phosphate levels in these samples were then measured and spiked by 2x, 4x, and 8x their original amounts to mimic different levels of loading in the system. We incubated the samples 24, 48 and 72 hours and analyzed them using light microscopy. We also filtered the treatments and filtered them through a 0.22 microns membrane and the DNA was extracted. 16 metabarcoding was done using Oxford Nanopore Technology. The sequences were analyzed using a ONT workflow for 16S metabarcoding. Our microscopy results showed that the diversity of samples spiked with phosphate were less diverse than the control. We are in the process of analyzing the 16s barcode.

Poster 36

Analyzing the toxicity of ferrous sulfate on Artemia salina survivorship rate.

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Metal contamination in aquatic environments is an increasing concern as industrial and agricultural waste continues to enter natural water systems. Among these pollutants, iron—often introduced as ferrous sulfate ($FeSO_4$)—can become harmful at elevated levels despite being naturally present in the environment. This study examined the toxicity of ferrous sulfate by evaluating its effects on the survival of Artemia salina (brine shrimp), a widely used indicator species in ecotoxicology research. Brine shrimp were exposed to ferrous sulfate concentrations ranging from 0 to 5 parts per million (ppm) to determine whether increasing levels would reduce survival rates. This concentration range was selected to capture potential early signs of toxicity and identify thresholds relevant to natural and polluted aquatic settings. Results showed minimal mortality across all tested concentrations, indicating low toxicity of ferrous sulfate within the 0–5 ppm range. Even at the highest concentration, survival remained high, suggesting that A. salina can tolerate ferrous sulfate at levels beyond those tested. These findings imply that the LC50 for ferrous sulfate exceeds 5 ppm and that future research should test higher concentration ranges to more accurately determine the metal's toxicity threshold.

Poster 37

The impact of urbanization on Pollinators Diversity

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Pollinators—including bees, butterflies, and other insects—are essential to ecosystem stability and global food production. By transferring pollen between flowers, they enable the reproduction of many plant species, including numerous fruits and vegetables relied upon by humans. However, pollinator populations are declining worldwide as urbanization replaces natural habitats with roads, buildings, and managed landscapes, reducing access to wildflowers, nesting sites, and other critical resources. This study investigated how increasing urban development affects pollinator diversity in Cold Spring Harbor, New York. Working in collaboration with Cold Spring Harbor Laboratory, we analyzed insect samples collected over a two year period to document which pollinator species were present and how their diversity changed over time. Species identification was conducted using DNA barcoding, a molecular technique that functions like a genetic fingerprint, allowing precise detection of both common and rare pollinators, including those that may be invasive or difficult to identify morphologically. Our findings provide insight into how expanding suburban landscapes may be reshaping pollinator communities. By revealing shifts in species presence and diversity, this research highlights the ecological impact of urbanization and underscores the need for conservation strategies that support pollinator habitats in developing regions such as Cold Spring Harbor.

Poster 38

The effects of Metallic Ions on Brine Shrimp

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Metal contamination is an increasing threat to aquatic ecosystems, where metals introduced through industrial discharge, mining runoff, and chemical spills can harm vulnerable organisms. Assessing the toxicity of specific metals and identifying the concentrations at which they become lethal is essential for protecting aquatic life. This study examined the effects of two metallic ions—zinc chloride and cobalt chloride—on the survival of brine shrimp (Artemia salina). We hypothesized that mortality would rise with increasing metal concentration and that zinc chloride would be more toxic due to its known disruptive effects on respiratory function in aquatic organisms. Brine shrimp were exposed to a series of increasing metal concentrations and monitored over a 24-hour period. Lethal concentration 50 (LC50) values were calculated to compare the toxicities of the two metals. Our results supported both predictions. Mortality increased consistently with concentration for each metal, and zinc chloride produced significantly higher death rates than cobalt chloride. Correspondingly, the LC50 for zinc chloride was lower, indicating greater toxicity. These findings contribute to understanding how different metallic pollutants affect small aquatic organisms and emphasize the particular importance of monitoring zinc levels to mitigate ecological harm.

Poster 39

The Impact of Temperature on the Survival of Brine Shrimp in a Natural Ecosystem

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Aquatic organisms must continually adapt to environmental changes, and brine shrimp—small but ecologically important members of natural water ecosystems—are especially sensitive to such shifts. Among the many environmental factors that influence their survival, temperature is one of the most critical. Because temperature regulates nearly all biological processes, even moderate fluctuations can affect brine shrimp physiology. Warm water reduces dissolved oxygen levels and accelerates metabolic rates, creating stress and limiting survival. Conversely, colder temperatures slow development and reduce hatching success, particularly in early life stages.

Previous research indicates that brine shrimp generally survive best within a broad but defined temperature range of approximately 6°C to 35°C, with survival declining outside this window. Based on this, we hypothesized that brine shrimp would show the highest survival at moderate, stable temperatures, and lower survival at both excessively high and low temperatures.

In this study, brine shrimp were exposed to varying temperature conditions to determine which range best supports their survival. Findings from this experiment will help clarify how temperature fluctuations influence brine shrimp populations and provide insight into how rising global temperatures may destabilize aquatic ecosystems that rely on these organisms.

Poster 40

Expression and Purification of pLG72

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This research builds from research articles examining potential biomarkers associated with Schizophrenia(SCZ). Elevated G72 mRNA and pLG72 protein levels have been identified in the blood and brain of SCZ patients (Loredano Pollegion *et al* 2018). pLG72 has been hypothesized as a regulator of D-Amino acid oxidase (DAAO), this enzyme modulates D-Serine levels and NMDA receptor signals. Reports suggest pLG72 may activate or destabilize DAAO. The goal of the study is to characterize pLG72 as there has been no structural information of pLG72 due to difficulty in expression and solubility. To combat this limitation a plasmid with the pLG72 gene will be transformed into *E coli* C41 cells, which are designed for the expression of difficult to solubilize proteins. After induction the cells will be lysed and fractioned to determine if the protein is in the soluble or insoluble Fraction. Successful expression and visualization of pLG72 will allow better understanding of its structural properties and allow for future investigation of its interaction with DAAO. Understanding this pathway could clarify its potential role in NMDA dysregulation associated with SCZ.

Poster 41

Evaluating the Effects of Aflatoxin B1 and Ochratoxin An on-Cell Migration and Viability in Human Cell Models

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Mycotoxins are toxic secondary metabolites produced by fungal species that contaminate food and indoor environments, particularly in settings affected by moisture damage and poor remediation. Among the most concerning mycotoxins, Aflatoxin B1 (AFB1) and Ochratoxin A (OTA) have been associated with cellular toxicity, oxidative stress, and increased cancer risk. This project investigates how AFB1 and OTA influence cell migration behavior and cell viability, two important indicators of toxicity and disease-related cellular dysfunction.

Human cell lines will be exposed to defined concentrations of AFB1 and OTA, and a cell migration (wound healing/cell closure) assay will be performed to monitor changes in migration over time. Images will be captured at defined time points (0, 12, and 24 hours, adjusted as needed for cell line-specific migration rates) using consistent imaging fields. Migration and wound closure will be quantified using ImageJ software. In parallel, cell viability and toxicity will be assessed using plate-based assays (VYBRANT MTT CELL PROLI) to evaluate dose-dependent effects of each toxin.

This study is currently in progress, and data collection is ongoing. We anticipate that toxin exposure will reduce cell viability and alter migration dynamics in a concentration-dependent manner. These findings are expected to support a broader investigation into how environmental fungal toxins may contribute to cancer-relevant cellular changes and health disparities in exposed communities.

Poster 42

Mycotoxin-Induced Cell Cycle Disruption in H1299 and DU145 Cells: A Student-Led Investigation of Aflatoxin B1 and Ochratoxin A

Anjelica Amankwah*, Lauren Sroud and Mowaffaq Adam

SUNY Old Westbury

Environmental fungal metabolites (mycotoxins) are increasingly recognized as important contributors to cellular stress and disease risk, including cancer. This project examines how two major mycotoxins, **Aflatoxin B1 (AFB1)** and **Ochratoxin A (OTA)**, affect **cell-cycle progression** in human cancer cell models. Because disruption of cell-cycle regulation is a hallmark of carcinogenesis, identifying how these toxins alter cell-cycle patterns may help clarify early mechanisms linking environmental exposure to cancer-related cellular damage.
In this study, **H1299** and **DU145** cells are treated with AFB1 and OTA under controlled laboratory conditions. Cell-cycle distribution is assessed using **propidium iodide (PI) staining** followed by **flow cytometry** to quantify DNA content and determine the proportion of cells in G0/G1, S, and G2/M phases. This approach allows evaluation of whether toxin exposure is associated with cell-cycle arrest, abnormal progression, or altered proliferation patterns.
This project is currently in the **early experimental stage**, and final results are not yet available. We anticipate that toxin-treated cells may show measurable shifts in cell-cycle phase distribution compared with untreated controls, supporting the hypothesis that mycotoxin exposure can interfere with normal cell-cycle regulation. The long-term goal of this work is to contribute to a broader research effort examining how environmentally relevant toxic exposures may promote cancer risk and health disparities in underserved communities.

Poster 43

Interspecific variation in Daphnia's responses to biocide exposure

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Biocides, including herbicides and pesticides, are commonly used in the United States, yet the effects of exposure to these toxicants on aquatic, non-target organisms remain relatively unexplored. In particular, closely related species may have similar responses to biocide exposures or there may be pronounced interspecific variation in toxicant tolerance among analogous species. To explore this question, we compared the responses of two ubiquitous water flea species (Daphnia magna and Daphnia ambigua) to the independent and combined effects of two common biocides (the pesticide Imidacloprid and the herbicide Glyphosate). We included a range of Imidacloprid (1.83-8.70 mg/L) and Glyphosate (7-56 mg/L) concentrations, and exposed Daphnia to each biocide independently, as well as to combination treatments of low, medium, and high concentrations, with the goal of including environmentally-realistic levels. We identified differences in survival, growth, and reproduction across our treatment combinations that demonstrate the effects of biocide exposure on both Daphnia species. In addition, there were pronounced differences between Daphnia magna and Daphnia ambigua, suggesting that the effects of biocides on non-target organisms may vary substantially within guilds.

SIGMA XI

THE SCIENTIFIC RESEARCH SOCIETY

Physical Sciences

Poster 44

Examining Relationships between Precipitable Water and Tropical Cyclone Precipitation in the Continental United States

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Extreme rainfall from tropical cyclones is among the most devastating and high impact meteorological phenomena capable of producing torrential rainfall and flooding across coastal and inland regions. This study examines the relationship between precipitable water (PWAT) and precipitation rate (PRATE) in Hurricane Helene (2024), and Hurricane Harvey (2017), two recent, prolific rainfall-producing storms. The High-Resolution Rapid Refresh (HRRR) model analyses were examined to determine the relationship between precipitable water and tropical cyclone precipitation. The HRRR 1-hour forecast PRATE was used a proxy for observed precipitation. Hurricane Helene exhibited a strong positive relationship between PWAT and rainfall rate indicating that higher atmospheric moisture corresponds to higher precipitation in discrete location. On the other hand, Hurricane Harvey produced extreme rainfall totals with a weaker PWAT and PRATE relationship. The calculated correlation coefficients reflected this difference, with Helene showing a tighter coupling between moisture and rainfall. This shows the importance of mesoscale complexities leading to catastrophic flooding. Ongoing work will extend this analysis to Hurricanes Florence (2018) and Hurricane Sally (2020) to clarify these discrepancies.

Poster 45

Marine Invertebrate Discoveries on Juvenile Sea Turtles of the Western Atlantic

Annabelle Bork*, Dr. Theodora Pinou

Western Connecticut State University

Marine invertebrates form unique communities that can be found on many different species of marine megafauna as well as abiotic substrata. This relationship between host and the colonizing marine invertebrate is called epibiosis. Studies have characterized the marine invertebrate communities on adult loggerhead, green, olive ridley, leatherbacks, and hawksbill sea turtles with less known about the Kemp's ridley and flatback sea turtle and little knowledge of juveniles' assemblages. This study characterizes and identifies the epibiont biodiversity of juvenile loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles in the Western Atlantic. 82 total sea turtles were sampled from by the Massachusetts Audubon Wellfleet Wildlife Sanctuary in 2018 and 2019. Results show consistency in the epibiont species colonizing conspecific adults in comparison to the juveniles for the loggerheads and green sea turtles. Adult Kemp's ridley sea turtles' marine invertebrate communities have not yet been characterized; therefore, this study will be the first to report on this subject. This data expands our knowledge of marine invertebrate communities, highlighting juvenile sea turtle assemblages.

Poster 46

What Protective Medium is the Best for Thermal iButton Efficacy?

Zeanna Graves*, Theodora Pinou

Western Connecticut State University

Temperature loggers are an efficient, accurate tool used by many scientific fields. However, loggers are subject to environmental damage because they are not waterproof. With this limitation, it is vital to protect loggers from direct environmental exposure. The iButton (*DS1921G-F5# Thermochron, 4K*) was the chosen model for this study because they are relatively inexpensive and accessible software system. This research aimed to discover a protective medium that protects the iButton without compromising the accuracy of the temperature readings. The mediums chosen were parafilm, petri dishes, Ziploc bags, specimen tubes and plasti-dip along with a control of no medium. Each medium was tested for accuracy in an oven, fridge and outside respectively for 24 hours. There were 5 replicates for each medium and a total of 30 iButtons were used for each environmental treatment. Results indicate that all mediums recorded temperatures significantly similar to the control, but ultimately it was determined that parafilm is the best option because it is cost efficient and simple to use. Parafilm also had the smallest variance among replicates, proving their reliability in the field. The results of this experiment help scientists curate temperature loggers to meet their needs.

Poster 47

Evaluating the Effectiveness of Revitalized Community Service at Western Connecticut State University

Alton Spencer, **James Kielkucki***

Western Connecticut State University, Astronomy

Outreach and effective scientific communication are essential in fostering the public's interest and understanding of science. Western Connecticut State University has brought back its monthly planetarium shows on the Westside campus, aiming to revitalize engagement with the public following a long stretch of inactivity from COVID. We analyzed the physical and digital logs of event attendance and pre-registration to assess the effectiveness of this renewed outreach effort using a paired T-test and Chi-Squared test, finding that registration numbers are significantly higher than final attendance ($p<0.05$). These results are broadly consistent across all 2025 shows, with higher attendance rates in Fall 2025 compared to Spring 2026. We attributed this higher attendance of these shows with improved communication and promotion through several online outlets. The two outliers with low attendance were attributed to miscommunication regarding event location/status and other ongoing events on campus. These issues were minimized in the final events of 2025. The renewed planetarium shows at WCSU have served as a useful case study for revitalizing local science engagement, applicable to our upcoming 2026 planetarium shows.

Poster 48

A Nuclear Magnetic Resonance Spectroscopy Study of Five Di-imine Molecules

Anahit Abernethy[1] and Eva Figlar[1], Dr. Colin Abernethy

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Nuclear Magnetic Resonance Spectroscopy (NMR) is a process used to determine the chemical environments of hydrogen and carbon atoms. This study aims to test five different aniline compounds to determine if they can serve as sufficient models for procedures using benchtop NMR. The compounds analyzed in the NMR Spectroscopy machine were synthesized using acetic acid, the precipitate was separated from the solution using a vacuum filtration system, and the powder from the solution was diluted using the NMR solvent: chloroform. Specific molecules provided cleaner readings on the NMR machine than others. The accuracy of data was measured if it included the correct number of signals and the integration ratios for both carbon-13 and hydrogen atoms. 2,4,6-trimethyl-phenyl-diazabutadiene, 2,6-diethyl-phenyl-diazabutadiene, 2,6-diisopropyl-phenyl-diazabutadiene, and 2,6- dimethyl-phenyl-diazabutadiene all gave accurate data. 4-bromo-2,6-dimethyl-phenyl-diazabutadiene did not yield accurate information, even with additional measures taken, such as increasing the number of scans and the concentration of the substance. It was determined that more soluble molecules are easier for the NMR machine to scan, and therefore, more soluble molecules yield more accurate data and contribute to better models. NMR is one of the fastest growing fields in chemistry, so by determining an array of molecules suitable for NMR education, future generations will be able to utilize these molecules, which produce clear NMR proton and carbon spectra.

Poster 49

Investigation of the Relationship between Upper Tropospheric Specific Humidity Anomalies and Integrated Vapor Transport in the Northern Pacific Ocean

Parker Brown*

Western Connecticut State University, Danbury CT

Investigation of the Relationship between Upper Tropospheric Specific Humidity Anomalies and Integrated Vapor Transport in the Northern Pacific Ocean
Atmospheric rivers (ARs), which are long, narrow corridors of strong water vapor transport, play a critical role in the water cycle for the West Coast of the US. Despite this, the large amount of precipitation released by ARs can lead to hazards such as flooding and mudslides. Although ARs are a subject of extensive research, some forecasting challenges remain due to a lack of observational data over the North Pacific Ocean, where ARs evolve rapidly and unpredictably. The current variable used to diagnose the intensity of ARs is integrated vapor transport (IVT). However, the calculation to evaluate IVT is complex and requires various precise observations done at many pressure levels in order to obtain an accurate result. Upper tropospheric specific humidity (UTH) is a simpler, easier variable to obtain. UTH is often overlooked when analyzing ARs, though, as the majority of IVT is located in the lower troposphere. This study investigates the relationship between UTH anomalies and IVT in the North Pacific Ocean from 2016-2017. Results find that UTH anomalies can precede an increase of IVT magnitude by 24 hours. Correlation between UTH and IVT increases northward and westward. The fall and winter also
show much higher correlations than the spring and summer.

Poster 50

Synthesis of JAK3 Inhibitors as Candidates for Treatment of Rheumatoid Arthritis

Tanner Poissant* and Nicholas J. Greco

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Rheumatoid arthritis is a chronic autoimmune disorder characterized by inflammation and degradation of synovial joints caused by excessive proinflammatory cytokine production from activated T-cells. This can lead to persistent inflammation, cartilage degradation, and irreversible bone erosion. The JAK/STAT signaling pathway regulates cytokine expression, making JAK inhibitors promising therapeutic agents. Selective inhibition of JAK3 is preferred because JAK3 is primarily expressed in lymphocytes, while inhibition of JAK1 or JAK2 is associated with adverse side effects including anemia and cardiovascular diseases. Therefore, the development of selective JAK3 inhibitors is an important strategy for improved rheumatoid arthritis treatment.
This project focuses on the synthesis of decorated 7-deazapurines at the 4 and 7 positions with vinylsulfonylpyrrolidine and nitrophenyl groups. Three target compounds will be prepared to evaluate how structural modifications affect binding affinity. Previous studies proved that modifying substituents on this scaffold allowed exploitation of hydrophobic pockets within the JAK3 active site, resulting in compounds with improved potency, selectivity, and in vivo anti-inflammatory activity. Biological activity will be evaluated using a luciferase-based binding assay to determine IC_{50} values for JAK3 inhibition and compare potency to known inhibitors reported in the literature.

Poster 51

Building an Instructional Apparatus for Quantum Key Distribution

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Quantum cryptography leverages the principles of quantum mechanics to enable secure key distribution. As quantum information science emerges as a transformative field, early exposure to its concepts and applications is essential for preparing students to engage with future technologies. To address this need, we built an automated, hands-on instructional apparatus that introduces students to quantum cryptography through an implementation inspired by the BB84 protocol. The system uses polarization-encoded light to transmit binary information between two parties, Alice and Bob. Alice sends polarization states using a laser source, while Bob performs polarization measurements with a photodiode to generate synchronized outcomes that form a shared key. Unlike research-grade quantum key distribution systems, the apparatus does not rely on single-photon sources or detectors; instead, it uses classical light levels, simplifying the design and making it more robust, portable, and cost-effective for instructional use. The resulting key is used to demonstrate encrypted message transmission through an infrared wireless communication system. The apparatus provides experiential learning in quantum key distribution while exposing students to optics, electronics, wireless communication, and Arduino-based data acquisition.

Poster 52

Quantum Chemistry on Bosonic Quantum Computers.

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Bosonic quantum processors offer a promising alternative to conventional qubit systems for chemistry calculations. We developed methods to compute both electronic and vibrational energy states of molecules with high accuracy while dramatically reducing computational requirements. By enforcing physical constraints, we reduced resource needs from linear to logarithmic scaling. Tests on small molecules achieved chemical accuracy, and vibrational calculations required orders of magnitude fewer operations than qubit-based approaches. The simpler computational circuits also showed better resistance to hardware errors, demonstrating practical advantages for molecular simulations.

Poster 53

Twisted by Fluorine: The Rotational Spectrum and Helical Geometry of Perfluorodecanonitrile, CF_3-$(CF_2)_8$-CN

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The pure rotational spectrum of perfluorodecanonitrile ($CF_3(CF_2)_8CN$) has been recorded and analyzed in the 6–18 GHz frequency range using chirped-pulse Fourier transform microwave (CP-FTMW) spectroscopy. This molecule represents a significant challenge for high-resolution gas-phase spectroscopy due to its large mass and high density of states, resulting in exceptionally
small rotational constants. The experimental spectrum is dense but was successfully assigned to the ground vibrational state. The determined rotational constants are A = 531.81986(8) MHz, B = 67.22344(14) MHz, and C = 66.87770(14) MHz.

Poster 54

Probing PEG Oligomers Using the STM-BJ

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Department of Chemistry and Biochemistry, Fairfield University

The photophysical properties of Vitamin B12 are a substantial factor that affects the molecule's ability to deliver drugs to target sites within the body. Prolonged release time, precise dosage dispensation, and the delivery of multiple agents are dependent on these photophysical properties. Previous research has found that the length of polyethylene glycol (PEG) oligomers covalently bonded to B12 determines the photophysical properties of B12. This research utilizes the Scanning Tunneling Microscopic Break Junction (STM-BJ) technique to create a single-molecule junction, which reveals the conductance and length of the molecule. PEG oligomers provided by collaborators in the Aaron Van Dyke Lab were measured, including the polyethylene glycol-linked protein monomer (PEG monomer) and dimer (PEG dimer). The concentration of the PEG oligomers, the solvent used, and the applied bias were varied to determine optimal conditions that produce a clear conductance peak and molecular length. The solvents tested included trichlorobenzene (TCB), propylene carbonate (PC), and tetradecane (TD). Additionally, coating the sides of the STM tip with wax was successfully used to reduce the Faradaic tunneling current caused by the dipole interaction between the polar solvent PC and gold atoms on the sides of the tip.

Poster 55

Integration of tetratolylporphyrin (TTP) into liposome carriers for administration to breast cancer cells

Yashfa Amer*, Randeeno Burrell*, Luciana Feire*, Thuraya Almontaser, Franchesca De La Rosa, Tahis Munoz, Dana DeMoninicis, Lorenzo Salegna, Pamela K. Kerrigan, Ph.D.

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Photodynamic therapy (PDT) offers a promising, minimally invasive strategy for selectively inducing apoptosis in cancer cells through the use of photosensitizers activated by light. This study focuses on the synthesis and liposomal encapsulation of tetratolylporphyrin (TTP), a hydrophobic photosensitizer, to enhance its solubility and delivery for PDT applications. TTP was synthesized via a modified Adler method and purified using column chromatography with 100% chloroform on 60Å mesh silica. Purity was confirmed through thin-layer chromatography (TLC), UV-Vis spectroscopy, and nuclear magnetic resonance (NMR). TTP was encapsulated in liposomes—lipid-based carriers that improve stability and circulation time. Liposomes were prepared by dissolving 14 mg of DPPC in 1.0 mL of absolute ethanol and combining it with 1.1 mg of TTP dissolved in a chloroform/ethanol mixture. The combined solution was added to phosphate buffer (0.10 M, 0.15 M NaCl, pH 7.4), heated at 55°C, cooled, and dialyzed for 24 hours. Successful encapsulation of TTP was verified by visible spectroscopy.

Poster 56

Synthesis and purification of Tetratolyl porphyrin (TTP) for use in PDT

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Porphyrins are tetrapyrrole compounds composed of four pyrrole subunits linked by meso bridges. In this study, tetratolylporphyrin (TTP) was synthesized using a modified Adler method and purified via column chromatography with 100% chloroform on 60Å mesh silica. Purity was confirmed through thin-layer chromatography (TLC), UV-Vis spectroscopy, and nuclear magnetic resonance (NMR). A significant amount of tarry by-product was generated during synthesis, and post-filtration analysis revealed that residual porphyrin was trapped within this solid waste. To recover the trapped porphyrin, the tar was dissolved in methanol, successfully releasing porphyrin that was then isolated by filtration. Ethanol was subsequently tested and found to dissolve the tar with comparable efficiency. Porphyrin samples recovered from both solvents were analyzed via TLC and showed purity levels similar to those obtained through traditional column chromatography. This solvent-based recovery method yielded several grams of purified porphyrin—substantially more than the few hundred milligrams typically obtained through chromatography—highlighting its potential as a scalable and efficient alternative for porphyrin purification.

Poster 57

Utilizing photodynamic therapy in breast cancer treatment

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Photodynamic therapy (PDT) employs light-activated photosensitizers to induce localized cytotoxicity in malignant tissues. This study explores the use of porphyrins—ring-shaped organic compounds composed of pyrrole subunits—as photosensitizers for targeted PDT in breast cancer treatment. Porphyrins were selected for their strong absorption at tissue-penetrating wavelengths and their efficient generation of reactive oxygen species upon light activation. To enhance bioavailability and tumor targeting, Tetratolylporphyrin (TTP) was encapsulated in liposomes—lipid-based carriers that improve stability and circulation time. Liposomes were prepared by dissolving 14 mg of DPPC in 1.0 mL of absolute ethanol and combining it with 1.1 mg of TTP dissolved in a chloroform/ethanol mixture. The combined solution was added to phosphate buffer (0.10 M, 0.15 M NaCl, pH 7.4), heated at 55°C, cooled, and dialyzed for 24 hours. Successful encapsulation of TTP was verified by visible spectroscopy. Prior to cell culture application, the liposomal formulation was sterilized using a 0.2 μm filter. Cultured cells were exposed to visible white light for one hour, followed by a 20-hour incubation period. Post-incubation, cell viability was assessed to evaluate PDT efficacy. Experimental results will be presented to demonstrate the therapeutic potential of liposome-encapsulated TTP in cancer treatment.

Poster 58

A Super-Earth and Two Long-Period Sub-Neptunes around the Young K-Dwarf TOI-6710

Alton Spencer*[1], Ismael Mireles[2] , Diana Dragomir[2], Hugh Osborn, Solène Ulmer-Moll[4] , Karen Collins[5], Richard Schwarz[5] Keivan Stassun[6], Don Dixon[6], Seth Redfield[7]

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Young (<1 GYR) exoplanet systems around bright stars provide useful case studies to test formation/evolution models and characterize planets in their earliest history. We identify 3 candidate signals around the K-Dwarf TOI-6710 with NASA's Transiting Exoplanet Survey Satellite (TESS) mission. A combined analysis of the star's rotational period, stellar isochrones, and velocity dispersion constrains the age of the system to only 330 (±100) MYR. Using statistical modelling and ground-based observations, we rule out false positive scenarios and confirm all 3 planets: an inner hot Super-Earth (P_b=2.1d) and two long-period Sub-Neptunes (P_c=34.2d, P_d≥99.2d). We only identified two transits of TOI-6710 d with TESS photometry, and further observations with ground and space-based observatories were only sufficient to rule out orbital periods shorter than 99 days. TOI-6710 is sufficiently bright to enable follow-up characterization of its three planets with ground and space-based instrumentation. As the longest-period and coolest (≤322 K) transiting Sub-Neptune around a young star, TOI-6710 d is a unique target to study the atmospheric chemistry of a young, temperate planet with the James Webb Space Telescope.

NOTES

COMMUTER PARKING GARAGE on White Street

Student Center