University of New England
College of Arts and Sciences
Westbrook College of Health Professions

Summer Undergraduate RESEARCH EXPERIENCE Symposium

SATURDAY
September 23, 2023

UNE
UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET

SCHEDULE

Saturday, September 23, 2023 | 9–11 a.m.

Alfond Center for Health Sciences Lobby

9–11 a.m. | Poster Presentations

10:30 a.m. | Remarks

Jonathan Millen, Ph.D.
Dean, College of Arts and Sciences

John Rosene, D.P.E., LAT, ATC, CSCS, ACSM EP-C
Clinical Professor, Westbrook College of Health Professions

Amy Keirstead, Ph.D.
Associate Dean, College of Arts and Sciences

RESEARCH AT UNE

Welcome to the 2023 Summer Undergraduate Research Experience (SURE) Symposium! This annual event features the work of our students in the College of Arts and Sciences and the Westbrook College of Health Professions that have performed research during the summer on our Maine campuses and at regions throughout the northeastern United States. Over the summer, our students worked closely with dedicated faculty and professional staff to build on the knowledge they have acquired through their coursework, to explore advanced realms of understanding, and to prepare for continued study in their fields.

Students from disciplines ranging from Chemistry and Marine Science to Applied Exercise Science and Political Science have spent their summer investigating a diverse array of research questions. These projects are the basis for future scholarly work in the field of research through articles, presentations, manuscripts, and more.

Please join us in celebrating the hard work, dedication, and creativity of our students and learning more about their fascinating projects. We hope you enjoy your day!

Amy Keirstead, Ph.D.
Associate Dean and Associate Professor of Chemistry
College of Arts and Sciences

John Rosene, D.P.E., LAT, ATC, CSCS, ACSM EP-C
Clinical Professor of Exercise and Sport Performance
Westbrook College of Health Professions

PRESENTATIONS

LEGEND

63. Goat Island Alternative Energy Project

Student Author(s) Cameron Indeck '22 | *Pam Morgan, Ph.D.* ***Faculty Advisor(s)***

Abstract

Goat Island, offshore Kennebunkport, Maine, has had an operating lighthouse since 1833. The lighthouse and buildings are powered by an underwater cable from the mainland, which is leaking electricity into the ocean.

Funded by

Kennebunkport Conservation Trust and the Gulf of Maine Institute.

1. Novel Cultivation Technique for a Common Species: Sea Lettuce *(Ulva lactuca)*

Sophia Tearman ’25 | *Carrie Byron, Ph.D.*

Sea lettuce is a commonly found species in Maine that has a high protein content. Working with Atlantic Sea Farms, novel cultivation techniques for this species were developed. These techniques included new seeding methods, understanding of life cycle patterns, and growth on different substrate types. Some sea lettuce lines have been out planted into the ocean and are currently being monitored, and there are plans to continue ocean grow-out for the winter season.

Atlantic Sea Farms, Aquaculture Research Institute

2. Using In Vivo Tagged RNA to Examine Autophagic Degradation of RNA Decay Fragments

Dez Schrankel ’24 | *Jennifer Garcia, Ph.D.*

Previous research suggests that RNA decay fragments associate within specific cell structures to be degraded. In vivo tagged RNA is one method of attaching fluorescent proteins to target mRNAs, making them visible under a microscope. Utilizing in vivo tagged RNA, we can distinguish RNA decay fragments from where they aggregate in the cell. In understanding how cell structures interact with these fragments, we can further support the presence of the autophagic degradation pathway.

3. The Effects of Vegetation Dieback Areas on New England Salt Marsh Vegetation

Caroline Fales '25 | *Pam Morgan, Ph.D., Will Kochtitzky, Ph.D.*

My project studied the effects of a major threat to New England salt marshes known as vegetation dieback areas, or mega-pools, on surrounding salt marsh vegetation. Vegetation dieback areas are characterized by a large, expanding area of standing water and a concurrent dieback of nearby. My project aimed to quantify this change by measuring percent cover of vegetation in proximity to several vegetation dieback areas on the Biddeford Pool salt marsh.

4. Impact of Prophylactic Ceftriaxone on Antimicrobial Resistance in Out-of-Hospital Cardiac Arrest Patients

Cailyn Wheeler '25 | *Kristin Burkholder, Ph.D.*

The goal of this study/poster is to discuss the use of ceftriaxone in out-of-hospital cardiac arrest patients. When patients arrive at the hospital prophylactic antibiotics (ceftriaxone) are administered to prevent early-onset pneumonia, as well as reduce the need for broad-spectrum antibiotics. This study looks at the risks and benefits of administering undirected broad-spectrum antibiotics, and if they can play a role in patients losing antibiotic resistance.

5. Using GIS and Drones to Advance American Chestnut Restoration

Abigail O'Hern '24 | *Thomas Klak, PhD., Will Kochtitzky Ph.D.*

Using UNE's DJI Mavic 3 drone, a survey was collected of UNE's transgenic chestnut orchard located in Cape Elizabeth, ME. Using a combination of software including Emlid Flow, Metashape, and ARCGIS, I created a model that, in theory, should be able to take the orthomosaic's digital elevation model and calculate accurate heights of every tree in the orchard. This model will help us rapidly quantify and identify growth patterns between hybrids, controls, and transgenic chestnuts.

6. A Spatial Genetic Analysis of *Quercus rubra* (Northern Red Oak) in the UNE 363 Woodlands

Sienna Matregrano '24 | *Greg Zogg, Ph.D., Steven Travis, Ph.D.*

The project, A Spatial Genetic Analysis of *Quercus rubra* (Northern Red Oak) in the UNE 363 Woodlands, produced a spatial genetic analysis of the northern red oak. Values indicating high inbreeding and differentiation among the three sites were observed. Trees within 8.3 meters were found to be significantly related. The spatial genetic analysis provides a building block for a community genetics approach observing how tree genetics affect other biotic factors in the UNE 363.

Forest Ecosystem Monitoring Cooperative,
Maine Space Grant Consortium

7. Visualizing Elastin-Like-Polymer Behavior with Atomic Force Microscopy

Ben Wheeler ’24 | *Eva Rose Balog, Ph.D., James Vesenka, Ph.D.*

Elastin-like-polymers (ELPs) are bioengineered polymers with unique structural properties that can be exploited for biosensing applications. Atomic force microscopy (AFM) is used to simultaneously mechanically induce structural changes and image the structures of ELPs with nanometer resolution. Two specific ELPs variants have been compared using AFM thus far.

National Science Foundation

8. Effects of Early Life Pain on Amygdalar CRF Expression in Developing Rodents

Brooklynn Merrill ’25, Megan Tomasch ’25 |
Michael Burman, Ph.D., Jared Zuke, B.S.

Early life pain increases susceptibility to chronic pain and mood disorders. Our rodent model mimics a typical Neonatal Intensive Care Unit experience, and consistently demonstrates involvement of corticotropin-releasing factor (CRF) in the central nucleus of the amygdala. We use RNAScope in-situ hybridization to identify differences in neurotransmitter expression as a function of age, sex, and neonatal pain experience. Current data suggests early life pain causes neurobiological changes during rodent development.

Kahn Family Foundation Summer Research Fellowship; COBRE for the Study of Pain and Sensory Function NIGMS

9. Establishing Pre-restoration Sites of *Agalinis maritima* on the Biddeford Pool Salt Marsh

Sam Walsh ’24 | *Pam Morgan, Ph.D.*

Agalinis maritima is a species of special concern, as stated by the state of Maine. It grows primarily in small, highly diverse sections of the salt marsh known as pannes, which are characterized by poorly draining soils. A future restoration project, proposed by the Rachel Carson National Wildlife Refuge, seeks to remedy the impacts of this infrastructure, restoring proper hydrology to the salt marsh, and potentially shifting established *Agalinis maritima* populations.

Friends of Scarborough Marsh

10. The Growth of Mega Pool Systems in 12 Maine Salt Marshes From 2009 to 2021

Katelyn DeWater ’25 | *Will Kochtitzky, Ph.D.*

Salt marshes are important ecosystems because they provide critical habitat for endangered species, and their soils sequester carbon from the atmosphere. Our study uses GIS to quantify the area change of salt marsh pools between 2009 and 2021 on twelve salt marshes in southern Maine. While pools can occur naturally, our results indicate that pools are expanding and eroding at least partially due to sea level rise, decreasing salt marsh resilience to climate change.

Maine Space Grant Consortium

11. Effect of Antimicrobial Peptides on Antibiotic-Mediated Killing of Bacterial Biofilms

Anjanadevi Govindaraj ’24, Alya Theriault ’24 | *Kristin Burkholder, Ph.D.*

Staphylococcus bacteria are common causes of biofilm-associated, drug-resistant infections, and novel anti-staphylococcal therapeutics are needed. We aim to test the effect of antimicrobial peptides on antibiotic susceptibility of staphylococcal biofilms. In this preliminary study, we compared traditional microbiological plating with a rapid spectrofluorometric method for testing the effect of AMPs on antibiotic efficacy against biofilms. Our findings suggest that plating is more sensitive than spectrofluorimetric methods for detecting changes in the viability of biofilm-resident bacteria.

12. Thermal Tolerance and Temperature Thresholds in Jonah Crabs

Anna Sinclair ’24 | *Markus Frederich, Ph.D.*

To predict impacts of climate change on marine invertebrates, several different conceptual frameworks of physiological thresholds for temperature stress are applied. It is unclear which of these different frameworks is biologically the most relevant. Therefore, we are testing in the Jonah crab, *Cancer borealis*, multiple thermal threshold concepts, and compare the respective results with oceanographic data from NOAA and NERACOOS buoys to understand which methods are best suited to predict climate change-driven changes in biogeography.

13. Comparison of Bone Density in College Male and Female Ice Hockey Players Throughout a Season

Sarah Collins ’24 | *Paul Visich, Ph.D., M.P.H.*

Bone Mineral Density (BMD) is an important health indicator of one’s bone health. Weight bearing activities are associated with an increase in BMD, though a reduction in BMD has been observed during a season in male basketball players (Klesges, et al, 1996). The purpose of this study was to assess changes in BMD in male and female hockey players throughout their season.

14. Postural Effects on Power Outputs and Lactate Recovery During the Wingate Test

Kiara Morse ’24 | *John Rosene, D.P.E.*

The purpose of this study was to examine the difference in power outputs and lactate recovery between seated, standing, and a combination of the two postures during the Wingate. There were no significant differences ($p > 0.05$) between postures for all power output and lactate recovery measurements. Therefore, the Wingate may be performed in any posture when measuring power outputs and lactate recovery.

15. Using eDNA as a Tool to Monitor Biodiversity

Josephine Pikowski ’26 | *Emily R. Pierce, M.S., Charles Tilburg, Ph.D., Tom Bryant, Markus Frederich, Ph.D.*

eDNA is a crucial tool for assessing biodiversity. The eDNA Sampler acquires samples at depth to prevent contamination of DNA from the water column. Utilizing retrospective samples, a metabarcoding pipeline processed sequencing data. To interpret the data, the temperature, salinity and wind conditions were modeled. For enabling eDNA surveys at different depths, work continues on developing a semiautonomous water sampler, setting up the bioinformatics pipeline to analyze the data, and providing the oceanography background.

16. Growing Lab Cultures of Invasive Tunicates

Kai Watkins ’24 | *Emily R. Pierce, M.S., Markus Frederich, Ph.D.*

“Tunicates” are filter-feeding marine invertebrates common in biofouling communities. In the Gulf of Maine there are many invasive species of tunicates. The goal of this project was to determine the best methods for maintaining and growing tunicate populations in the lab for use in future studies into using environment DNA (eDNA) as a novel detection method for these invaders and for research looking at larval-bacterial interactions to better understand larval attachment.

Funded by Maine’s NSF EPSCoR RII Track-1 Maine-eDNA Project

17. Assessing Thermal Stress Impacts on Fluorescent Proteins in *Acropora cervicornis*: A Blueprint for Ambient Reef Lighting Design and Construction

Caitlin Cournoyer ’26 | *Jeri Fox, Ph.D.*

Acropora cervicornis, commonly called Staghorn coral, is a pivotal reef-building species in Mesoamerican reefs, classified as critically endangered by NOAA Fisheries. This study delves into the impact of thermal stress on coral survival and fluorescent proteins, necessitating a controlled environment. However, maintaining such conditions in tanks is challenging due to inadequate lighting. This research focuses on designing optimal growth lighting for *Acropora cervicornis*, encompassing light intensity, spectral composition, duration, technology, and placement within the tank system.

18. Can White Hake Otolith Chemistry be Used to Track Warming in the Gulf of Maine?

Ben Gowell ’25 | *John Mohan, Ph.D.*

Climate change has been reshaping the Gulf of Maine (GoM) ecosystem, and may contribute to fish stock declines. With several economically and ecologically important GoM marine species being directly impacted by climate change, long term monitoring of this phenomenon is needed. In this study, we utilize stable isotopes and trace elements in white hake otoliths as a means of tracking increasing temperatures over two decades.

19. Assessing the Efficiency of a Microprocessor-based Bycatch Reduction Device on the Atlantic Spiny Dogfish *(Squalus acanthias)* in Recreational Fisheries

Clayton Nyiri ’25 | *John Mohan, Ph.D., Michael D. Nguyen, M.S., Sara Mirabilio, M.S., Richard Brill, Ph.D., Peter Bushnell, Ph.D., Walter Golet, Ph.D., Ilan Levine, Ph.D., Brian Davis, Ph.D.*

Bycatch is when nontarget organisms are caught in recreational and commercial fisheries, causing reduced catch rates of target species. We test the hypothesis that a microprocessor-based bycatch reduction device will overstimulate the electroreceptors of cartilaginous sharks and reduce the catch rate of spiny dogfish *(Squalus acanthias)*. We report a 58% reduction in spiny dogfish catch rates on active rods emitting an electrical field compared to non-active rods, with target species catch rates being unaffected.

NOAA Saltonstall-Kennedy Program

20. Journeys of Resilience: The Iraqi Diaspora’s Path to Integration in the United States

Hauraa Alsilawi ’24 | *Samuel McReynolds, Ph.D.*

The Iraqi diaspora in the United States emerged as a unique and rather sophisticated community driven by historical events from the Gulf War, to the 2003 US invasion as well as the 2014 ISIS invasion. This paper examines the significant presence of the Iraqi population in the United States. Utilizing diverse sources such as the US Census, the Department of Homeland Security, and the Iraq Department of Migration, this study seeks to uncover the challenges and success of the Iraqi integration process in the US. Ultimately, this research depicts the story of one of many immigrant groups in the United States, serving as a resource for policymakers and promoting understanding and compassion for displaced peoples around the world.

St. Francis College Class of 1969

21. Differential Activation of Deep and Superficial Multifidus Fibers During Walking: A Pilot Study

Patrick Mead B.S. ’22, ’25 | *Michael Lawrence, M.S.*

This study assessed the activation patterns of deep and superficial multifidus muscles during walking. We used both surface and indwelling electrodes to measure muscle activation in healthy individuals. We found that surface electrodes may be sufficient to describe superficial multifidus activation. Additionally, deep multifidus had significantly higher activation compared to superficial multifidus. This suggests the need to measure deep and superficial multifidus independently and emphasizes the importance of deep multifidus activation during low-level functional activities.

22. Exploring Stable Isotope Analysis of Atlantic Bluefin Tuna *(Thunnus thynnus)* Eye Lenses

Emma Christopher ’25 | *John Mohan, Ph.D.*

Atlantic Bluefin Tuna, *Thunnus thynnus*, are highly migratory apex predators that ecosystems and fisheries rely upon. Fish eye lenses, being made of crystallin protein, are suitable for stable isotope analysis of $\delta^{13}C$ and $\delta^{15}N$. Eye lenses grow like onions, with each layer recording different stages of life. Here, we used stable isotope analysis of *T. thynnus* eye lenses to evaluate life history shifts in feeding and migration.

23. Microplastic Contamination and Tissue Distribution in Atlantic Sea Scallops

Amber-Rae Pesek ’24 | *Kristin Burkholder, Ph.D.*

Ocean microplastics may pose a risk to seafood safety. Microplastics are ingested by marine organisms such as sea scallops, but it is unclear whether microplastics remain in the scallop digestive tract, which is not often consumed by humans, or translocate to edible tissues such as the adductor muscle. Here, we extracted and quantified microplastics from the gut and adductor muscle of Atlantic sea scallops to compare microplastic levels in edible versus non-edible scallop tissue.

24. Antimicrobial Compounds in Reproductive Parts of the Seaweed *Fucus vesiculosus* and Their Effectiveness Against Human Pathogens

Claire Dyer ’26 | *Ursula Roese, Ph.D.*

Extracts from the reproductive parts of the macroalga *Fucus vesiculosus* were investigated for surface-originating antimicrobial activity against three gram-positive human pathogens: methicillin susceptible *Staphylococcus aureus Newman*, methicillin resistant *Staphylococcus aureus USA300* (MRSA) and *Staphylococcus epidermidis*. The Roese lab found previously that extracts from entire algae contain compounds are effective against these human pathogens. Extracts from the reproductive parts of the algae were not found to be effective against Newman, USA300 or MRSA.

25. Observing Mitochondrial Dysfunction in *Saccharomyces cerevisiae*

Abigail Blouch ’24 | *Jennifer Garcia, Ph.D.*

Amyotrophic Lateral Sclerosis is a fatal neurodegenerative disease that has been associated with mutations in either RNA metabolism, mitochondrial function, or autophagy. We seek to test if autophagy can be overloaded by improper RNA metabolism and lead to mitochondrial dysfunction in yeast. We used a colorimetric assay and developed a method to quantitatively assess and visualize mitochondrial dysfunction in strains that overloaded autophagy. Supporting our hypothesis, we observed increased mitochondrial dysfunction when autophagy was overloaded.

Kahn Family Foundation

26. Phase Behavior of Multi-Stimuli Responsive Biopolymers

Peter Swanson ’24, Ben Wheeler ’24 | *Eva Balog, Ph.D.*

Presented herein is the design, production, and characterization of several stimuli responsive elastin-like biopolymers. We use dynamic light scattering, zeta potential measurements, and atomic force microscopy to show our biopolymers are responsive to solution environment, ligand binding, and temperature.

27. Oxidation Reactions with Dicopper Catalysts in Hydrogen Peroxide Solution

Will DeFroscia ’24 | *Stephen Fox, Ph.D.*

This investigation looks into oxidation catalysis using hydrogen peroxide and dicopper naphthyridine diimine complex catalysts. A range of hydrocarbons were oxidized in good yields (as analyzed by gas chromatography) to produce alcohols and ketones. This is a promising pilot study into this class of oxidation catalytic reactions.

Maine Space Grant Consortium

28. Epigenetic Changes in DNA Methylation are Involved in the Lasting changes in Pain Sensitivity Following Neonatal Intensive Care Unit (NICU)-like Treatment in Rats

Aidan J.G. Fox ’24, Emma Naess ’24, Megan Tomasch ’25 | *Michael Burman, Ph.D., Jared Zuke, B.S.*

Neonates that spend time in the neonatal intensive care unit (NICU) have an increased susceptibility to later-life pain, but the mechanisms remain unknown. The Burman Collaborative has created an animal model of NICU exposure that produces tactile hypersensitivity later in life. This project examines whether epigenetic changes caused by neonatal trauma are responsible for those effects. We hypothesize that injecting 5-AzaC, a DNA methyltransferase inhibitor, will reverse the observed hypersensitivity.

Kahn Family Foundation

DIRECTORY

POSTERS BY AUTHOR

THANK YOU

THANK YOU!

The annual SURE Symposium would not be possible without the support of many individuals and organizations who each contribute in their own way.

First a hearty **THANK YOU** to the faculty mentors and professional staff who have supported the students in carrying out the research presented here today. Your generosity of time and effort has allowed the students to complete truly remarkable work. Likewise, the College of Arts and Sciences Undergraduate Research, Scholarship, and Creative Activity Committee was instrumental in the success of our 2023 CAS SURE program.

Several agencies have sponsored the students' summer research through fellowships and grants including the Atlantic Sea Farms, Aquaculture Research Institute, Friends of Scarborough Marsh, the Forest Ecosystem Monitoring Cooperative, the National Science Foundation, the Kahn Family Foundation, the National Oceanic and Atmospheric Administration, the Maine Space Grant Consortium, the St. Francis College Class of 1969, the UNE Office of Research and Scholarship, the UNE Girard Marine Science Center, and the UNE College of Arts and Sciences and the Westbrook College of Health Professions' Dean's Offices. Thank you for your investment in our students. Appreciation is also extended to UNE Institutional Advancement and the Office of Communications for their help in executing our event.

Thank you to all of the family and friends who have traveled to UNE to support their students during this event, and for your support during their busy summer research period.

Finally, we'd like to extend a special thank you to Erinn Stetson who has provided invaluable logistical and tactical support during all stages of the SURE 2023 program, including this symposium, and to Jesse Leighton for his assistance with poster printing.

—Dr. Amy Keirstead

—Dr. John Rosene

UNE

UNIVERSITY OF
NEW ENGLAND

INNOVATION FOR A HEALTHIER PLANET