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

SUMMER UNDERGRADUATE RESEARCH EXPERIENCE SYMPOSIUM

UNE
UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET

Saturday • October 1, 2022

SCHEDULE

Saturday, October 1, 2022 | 9–11 a.m.

Alfond Center for Health Sciences Lobby

9–11 a.m. | Poster Presentations

10:30 a.m. | Remarks

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

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

John Mohan, Ph.D.
Assistant Professor, College of Arts and Sciences

RESEARCH AT UNE

Welcome to the 2022 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 who 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 biochemistry and marine science to applied exercise science and environmental science have spent their summer investigating a diverse array of research questions, including:

- *How do face masks impact an individual's performance while exercising?*
- *How do the migratory paths of the bobolink compare between populations?*
- *What factors contribute to bacterial contamination in Biddeford Pool?*
- *How does thoracic spine manipulation impact hip adductor strength over time?*
- *Can we design new molecules with increased activity against common pathogens?*

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. Thoracic Spine Manipulation Increases Hip Adduction Force but Does Not Alleviate Asymmetries

Samantha DeAngelo ’23 | *Michael Lawrence, M.S.*

High velocity low amplitude thrust (HVLAT) is a technique used by manual therapists to increase neuromuscular innervation in an attempt to mitigate bilateral imbalances. However, some HVLAT are utilized in the clinic without supporting empirical evidence. Our goal was to determine if HVLAT to the thoracic spine reduces hip adductor strength imbalances both immediately and 48 hours post-manipulation.

Raymond Chiropractic

2. Investigating Migratory Paths of Bobolinks *(Dolichonyx oryzivorus)* in Maine, Pennsylvania, and Vermont

Holly Stone ’24 | *Noah Perlut, Ph.D.*

This project focuses on the tracking of birds over the migratory seasons of 2021 and 2022 and compares the differences between their migratory paths. This includes comparing age groups, sex, average timing of migration, etc. Motus tags were used to track several birds from Maine, Vermont, and Pennsylvania.

3. Soil Microbial Diversity and the Relationship with Red Oak and White Pine Tree Genetic Diversity

Meghan Hanks ’23 | *Greg Zogg, Ph.D.*

During the summer of 2022, I worked to answer the research question, "Are soil fungal communities more similar under genetically related oak trees?" Even though the goals changed, I was able to research, develop, and execute a soil sampling protocol in the permanent study plots in UNE's 363 acres. Although I was not able to analyze the samples during the summer, all the samples are prepared for DNA extraction in the fall.

4. Using Groundfish Rods and Field Trials To Determine if Electronic Bycatch Reduction Devices (BRDs) Will Deter Spiny Dogfish, *Squalus acanthias*

Clayton Nyiri ’24 | *John Mohan, Ph.D.*

Bycatch reduction devices (BRDs) are designed to let out voltages in a series of pulses to disturb sharks’ electroreceptors, Ampullae of Lorenzini, and deter them from longline hooks. Overall, the goal is to reduce bycatch in longline fisheries. The spiny dogfish *(Squalus acanthias)* was selected as a model species to determine how effective BRDs work on groundfish rods. Pooled and unpooled data indicated that rods with active BRDs caught fewer spiny dogfish than those with non-active BRDs.

5. Refinement and Continuation of Darling58 Pollen Production, Seedling Maintenance, and Pollination Techniques

Virginia Grace May ’24 | *Thomas Klak, Ph.D*

In eight weeks, the current methods of UNE’s American Chestnut project were expanded upon to achieve breakthrough progress for the nationwide restoration. The advancements were made in three major areas of the project: speed breeding pollen production in the greenhouse, the maintenance of transgenic orchards, and controlled pollination of wild trees. The latest changes have allowed the progression of generations of transgenic chestnuts, potential creation of homozygous embryos, and pollination of over 700 wild flowers.

The Cricket Foundation and the American Chestnut Foundation

6. Physiological and Subjective Changes While Wearing a Facemask When Peforming Exercise at Different Intensities

Nicholas Campbell ’24, Ellie Dekker ’21, Karli Stroshine ’21, Ty Wilhelmson ’21, Matthew Cardona ’21, Brittany Norman ’21, Connor Whitehead ’21 | *Paul Visich, Ph. D.*

This poster describes our study on masking and its effects on physiological and subjective parameters during exercise. It will provide a brief insight on masking requirements during the COVID-19 pandemic and dive into the methodology of our study and how measurements were recorded. Then, it will provide an overview of our data analysis and the results of our trials. Lastly, we will highlight our findings and any relevant health concerns.

7. Diet Comparison Between *Halichoerus grypus* (Grey Seal) and *Phoca vitulina* (Harbor Seal) Through DNA Found in Chyme and Fecal Matter Within the Intestine

Taylor Gibson, B.S. '22 (M.S. Marine Science '23) | *Kathryn Ono, Ph.D., and Zachary Olson, Ph.D.*

Seals forage at sea for prey, making the consumption of prey non-visible. Alternative methods of analysis can be utilized to identify the composition and abundance of the prey being consumed. Using the intestinal contents from both grey *(Halichoerus grypus)* and harbor seals *(Phoca vitulina)*, DNA analysis can be done to identify consumed prey. The intestinal DNA results can be compared to results from diet studies done on blubber and stomachs of the same seal specimen.

National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center

8. Toward the Creation of a Novel Interleukin-6 Responsive Biopolymer for Sensing Applications

Peter Swanson '24 | *Eva Rose M. Balog, Ph.D.*

In response to the fourth industrial revolution and the next generation of regenerative medicine and synthetic organ production, a novel sensor is needed to detect biomolecular analytes specific to monitoring cellular health status. Presented herein is the pathway and methodology used to create an interleukin-6 responsive protein polymer to be used in on-demand, real-time surveillance during tissue and organ growth and transport.

9. A Novel Insulin-Sensing Genetically Engineered Polymer

Jeffery Waters ’23 | *Eva Rose M. Balog, Ph.D.*

Insulin is an important metabolic marker in cellular bio-manufacturing. Toward the generation of an insulin-responsive protein polymer for sensing applications, we present the cloning, expression, and purification of a stimuli-responsive polymer fused to a putative insulin-binding motif.

10. Synthesis and Characterization of Catechol Derivatives With Varied Chain Lengths: Are the Aromatic Hydroxyl Groups and Ketone Essential for Antimicrobial Activity?

Savannah Wakita ’24 | *Amy Deveau, Ph.D.*

This poster describes the synthesis and characterization of hybrid compounds using laboratory methods established by the Deveau lab and best practices in the literature. This research explored the optimization of synthetic methods for catechol-based hybrid derivatives that are important controls in ongoing structure-activity studies.

11. Synthesis and Structural Characterization of Pyrogallol Derivatives With Antimicrobial Properties

Carolyn Curley ’23, Sarah Padellaro ’23 | *Amy Deveau, Ph.D.*

Antimicrobial resistance is a leading threat to global human health. Hybrid molecules featuring a pyrogallol core, ketone linker, and various length hydrocarbon chains have been identified to effectively impede drug-resistant pathogens. To determine if the ketone group is essential for antimicrobial activity, the compounds were reduced to their methylene and alcohol derivatives. Products were characterized by proton (^{1}H) and carbon (^{13}C) NMR spectroscopy and sent to the Burkholder Laboratory for antimicrobial analysis.

Maine Space Grant Consortium

12. Pyrogallol-Hydrocarbon Hybrids Potentiate Antibiotic Efficacy Against Pathogenic Staphylococcus

Lauren Cooper ’22, Carolyn Curley ’23, Sarah Padellaro ’23 | *Kristin Burkholder, Ph.D*

A novel approach to treating antimicrobial-resistant bacterial infections is the addition of adjuvant compounds to increase efficacy of existing antibiotics. Our lab found that the phenolic compound pyrogallol increases activity of certain antibiotics against *staphylococci*. Here, we show that addition of hydrocarbon chains to pyrogallol increases its adjuvant properties when used in conjunction with the antibiotic linezolid. Data suggest potential utility of these hybrid compounds as antimicrobial adjuvants against drug-resistant *staphylococci*.

This project was funded in part by an UNE Office of Research and Scholarship minigrant awarded to Kristin Burkholder.

13. Production of Antimicrobial Compounds From the Local Marine Red Alga *Chondrus crispus*

Marie Hoehner ’23 | *Ursula Röse, Ph.D.*

This summer’s research further explored the inhibitory effects of the alga *Chondrus crispus* against the gram-positive human pathogens: *Staphylococcus aureus* Newman and USA300 (MRSA) and *Staphylococcus epidermidis*. Disk assays were used to compare results between five treatment groups: Control, Old (Mature Algae), Mechanical Injury, Methyl jasmonate, and 25 °C (to determine if *C. crispus* is temperature sensitive). It was found that the Control group displayed the most inhibition while the elevated temperature group had the least.

Maine Space Grant Consortium

14. Exploring Maternity in Spiny Dogfish *(Squalus acanthias)*

Ruhika Bhattacharya ’24 | *John Mohan, Ph.D.*, *Steven Travis, Ph.D.*

Spiny dogfish *(Squalus acanthias)* is a small squaliform species found along the North Atlantic Ocean. Global shark populations are becoming vulnerable due to overfishing and bycatch. Reproductive biology investigations are required to improve both species-specific management and understanding of spiny dogfish life history. In this study, microsatellite primers were used to estimate maternity and genetically match dogfish pups to their mothers to investigate maternal transfer of elements and stable isotopes.

Maine Sea Grant

15. Furthering an Understanding of Community Genetics in an Oak-Pine Forest: Spatial Genetic Structure and Genetic Neighborhoods

Daniel Mitchell '23 | *Steven Travis, Ph.D.*

During this summer, methods developed by a prior SURE student were used to analyze the spatial genetic structure of *Quercus rubra* within UNE's 363-acre forest. Analyses carried out this summer yielded preliminary results indicating the existence of genetic neighborhoods within each of our three study plots. Neighborhoods consisted of a few oak clusters showing high relatedness. This research holds great importance, as the methods used this summer have applications with other tree species and environments.

Forest Ecosystem Monitoring Cooperative (FEMC)

16. Effects of Kelp Farm Removal on Small Invertebrate Community Dynamics Off the Gulf of Maine

Anna Winkler '23 | *Carrie Byron, Ph.D., Emilly Schutt, M.S.*

It has been proposed that kelp farms provide habitat for wild organisms. Small invertebrate abundances were compared across seasons as kelp farm gear is removed during the summer non-growing season. This project surveyed small invertebrates within kelp farm sites in Casco and Saco Bay during the summer of 2022. Data from this summer, combined with that of Emilly Schutt (M.S. '22) over a two-year period suggests lower invertebrate abundances during the winter kelp growing season.

17. Identification of Fecal Contamination in Water Using Microbial Source Tracking

Yesul Kang ’22, Jakob Maynard ’24 | *Zachary Olson, Ph.D., Kristin Burkholder, Ph.D.*

Signs of fecal contamination have led to frequent closures of Biddeford Pool, a crucial landmark of Biddeford, Maine. Water samples from surrounding watersheds were collected and analyzed for fecal indicator bacteria, Enterococci. Microbiological assays revealed that 43 of 128 samples reached the minimum threshold; molecular assays narrowed the potential sources of contamination to mammalian organisms. Future work will identify the exact species followed by remediation efforts to enhance water quality and ecosystem health.

Saint Francis College Class of ’69 Summer Undergraduate Research Fellowship

18. Measuring the Tidal Effect on Bacteria in Biddeford Pool

Jakob Maynard ’24 | *Charles Tilburg, Ph.D.*

Biddeford Pool has seen an increase in fecal bacteria content in the last few years, prompting the shellfish industry to take a pause for months at a time. Over the summer, I have used drifters to determine the flow of tidal currents and lay the groundwork to predicting the influence of the tide on fecal contamination, which I have been simultaneously measuring throughout the summer alongside Maine Department of Environmental Protection.

Maine Space Grant Consortium

19. You Can't Tune a Shark, but You Can Tuna Fish! Microchemistry Comparisons Between Atlantic Populations of White Sharks and Bluefin Tuna

Leo Edmondson '24 | *John Mohan, Ph.D.*

This project intended to investigate the elemental composition in the hard parts (fish otoliths and shark vertebrae) of two highly migratory, endothermic species: the white shark *(Carcharodon carcharias)* and the Atlantic bluefin tuna *(Thunnus thynnus)*. Hard parts act as a natural tag, allowing a more complete portrait of life history than conventional tags. Comparing two physiologically similar species may allow for elucidation of their respective life histories as well as different mechanisms of elemental uptake.

20. Bone Mineral Density in Weight Bearing and Non-Weight Bearing Exercise Paired With Resistance Training

Sarah Familia Castro '23, Ty Wilhelmson '21, Matthew Cardona '21, Brittany Norman '21, Connor Whitehead '21 | *Paul Visich, Ph.D.*

This poster will describe Bone Mineral Density (BMD) and the relevancy of the population. It will compare BMD in weight-bearing and non-weight bearing exercise paired with resistance training. It will describe the methods used to recruit our desired population and the tools used to analyze BMD in the subjects. It will detail results referencing total body and lumbar spine measurements and provide a conclusion of results with a broad understanding of the population's BMD referencing physical activity.

21. Vision Training as a Tool to Improve Neck Reaction Time and Stiffness

Ali Dresser '23 | *John M. Rosene, Ph.D.*

8-week neck strengthening and/or vision training program will improve sternocleidomastoid(SCM) reaction time in response to external load. Subjects pre/post-tested for electromyographic activity right/left SCM response to an external load applied to head. Vision training group decreased right SCM activation time and left SCM peak EMG activity decreased in neck training group which were significantly different from all other groups. Vision training appears to enhance SCM activation time on the dominant side when exposed to an external force.

Funded by SURE program and NEACSM undergraduate research grant.

DIRECTORY

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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 Committee was instrumental in the success of our 2022 CAS SURE program.

Several agencies have sponsored the students' summer research through fellowships and grants, including the Cricket Foundation, the American Chestnut Foundation, Raymond Chiropractic, the National Marine Fisheries Service, the Northeast Fisheries Science Center, Maine Sea Grant, the Forest Ecosystem Monitoring Cooperative, 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' Deans' 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 2022 program, including this symposium, and to Jocelyn Nerney for her assistance with poster printing.

—Dr. Amy Keirstead

—Dr. John Rosene

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