2024 Frances S. Sterrett Environmental Chemistry Symposium

Saturday, November 9, 2024
9:00 AM – 1:45 PM

Berliner Hall Room 117
Hofstra University
Hempstead, N.Y. 11549-1000

Micro-Plastics: Macro-Problem?

Unveiling Threats, Innovative Detection, and Strategic Mitigation

ACS Chemistry for Life®

ACS Local Section New York Long Island Subsection

HOFSTRA UNIVERSITY

Find Information: http://newyorkacs.online/sterrett/

Registration (free): using the link 2024 LIACS-ECY

Contact: Dr. Paris Svoronos – Symposium Chair

ACS Local Section New York Long Island Subsection

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The Frances S. Sterrett Environmental Chemistry Symposium is dedicated to presenting the public with up-to-date, factual scientific information on environmental topics. The symposium is organized by members of the Long Island Subsection of the American Chemical Society (LIACS) and cosponsored by the New York Section of the American Chemical Society (NYACS). The 2024 year's event is made possible with support from ACS LS-Sustainability Programming Grant, and Hofstra University's Chemistry Department. We invite you to join us and gain invaluable insights from field experts as they illuminate the pervasive issue of microplastics; and explore the latest advancements in detection methods and mitigation strategies to address this pressing environmental challenge.

For more information regarding the Environmental Symposium, LIACS, and NYACS, please visit the following sites:

- Frances S. Sterrett Environmental Symposium – http://newyorkacs.online/sterrett/
- Long Island Subsection – http://newyorkacs.online/long-island-subsection/
- New York Section – http://newyorkacs.online/

Acknowledgements:

- The organizing committee extends its gratitude to Dr. Brian Gibney, the NYACS webmaster for his technical assistance in managing the symposium webpage and promoting the event. We also appreciate the Hofstra University IT department for their support in facilitating the Zoom sessions.

Frances S. Sterrett Environmental Chemistry Symposium Committee:

Dr. Paris Svoronos (Committee Chair)
Dr. Kevin Bisceglia
Dr. Ronald P. D'Amelia
Mr. Rocco Di Stefano
Dr. Ping Furlan
Dr. Barbara Hillery
Dr. Neil Jespersen
Dr. William Nirode
Dr. Frank Romano
Dr. Qi Wang
Dr. Sujun Wei

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Agenda

08:30 AM	**Registration and Welcome; Light Refreshments**
09:00 AM	Welcoming Remarks **Dr. Paris Svoronos**; *Chair, 2024 Frances S. Sterrett Environmental Chemistry Symposium* **Dr. William Nirode**; *Chair, Department of Chemistry, Hofstra University* **Dr. Charles Riodan;** *Provost and Senior Vice President for Academic Affairs, Hofstra University* **Dr. Ping Furlan**; *Chair, 2024 ACS New York Section* **Dr. Sujun Wei**; *Chair, 2024 ACS Long Island Subsection*
09:15 AM	Interactions Between Plastic Particles and Aquatic Suspension-Feeding Invertebrates: Searching for a Bioindicator of Microplastics in the Environment (Zoom) **Dr. J. Evan Ward;** *Professor and Head, Department of Marine Sciences, University of Connecticut*
09:45AM	The Microplastic Problem Through a Microbial Lens **Dr. Cody Garrison**; *Assistant Professor, Department of Biology , SUNY Old Westbury*
10:15 AM	**Break**
10:25 AM	From the Arctic to the Antarctic, Microplastics are Pervasive in the Ocean **Dr. Luis Ernesto Medina Faull;** *Lecturer and IDEA Fellow, School of Marine and Atmospheric Sciences, Stony Brook University*
10:55 AM	Microplastic and Nanoplastic Exposure Through Tap Water **Ms. Huiping Deng**; *PhD Student, Lamont Doherty Earth Observatory, Columbia Climate School, Columbia University*
11:25 AM	Characterization of Microplastics by Using a Novel Method of Pyrolysis GC-MS **Dr. Ashok Deshpande**; *Research Chemist, Northeast Fisheries Science Center, Sandy Hook Laboratory National Oceanic Atmospheric Administration*
11:55 AM	**Lunch** Announcement of the ACS Salute to Excellence Award to Hofstra University Chemistry Department (The formal presentation is scheduled for Jan 25th at the 2025 Section-Wide Conference of the NYACS)
12:35 PM	Silent Invasion: The Remarkable Presence of Nanoplastics in the Human Body (Zoom) **Dr. Matthew J. Campen;** *Distinguished Professor, College of Pharmacy, University of New Mexico*
01:05 PM	Tracking the Biological Barrier-Crossing Behavior of Nanoplastics (Zoom) **Dr. Huiyuan Guo;** *Assistant Professor, Department of Chemistry, Binghamton University*
01:35 PM	Closing Remarks **Dr. Carlos Sanhueza**; *Chair-Elect, 2024 ACS Long Island Subsection*

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09:15 -09:45 AM

Dr. J. Evan Ward

Professor and Head
Department of Marine Sciences
University of Connecticut

Interactions between plastic particles and aquatic suspension-feeding invertebrates: searching for a bioindicator of microplastics in the environment

Abstract

As the global movement to determine environmental impacts of microplastics grows, there is a crucial need for efficient and standardized methods to monitor particle abundance in marine systems. One of the many problems with determining environmental loads of suspended microplastics is the need for broad-scale sampling of water, which is time consuming and often expensive. Additionally, sampling efforts are episodic rather than continuous, and results can be influenced by stochastic oceanographic processes that redistribute or concentrate particles on short time scales (hours). To address the burgeoning monitoring requirements for environmental microplastics, researchers have begun looking for taxa that could serve as bioindicators for plastic particles in the environment. Recently, many studies have focused on benthic suspension-feeding invertebrates because they process large volumes of water per unit time, capture particles as small as 1 μm with high efficiency, and interact with microplastics of different shapes and sizes suspended in the water column. Additionally, many benthic suspension feeders are broadly distributed, abundant and easily accessible, and some have been used by monitoring programs as indicators of pollutants (e.g., petroleum hydrocarbons, metals). This presentation will explore the feeding interactions between plastic particles and several groups of suspension-feeding invertebrates (i.e., bivalves, snails, tunicates) and discuss the pros and cons of using each as an indicator of microplastics in the environment.

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Dr. J. Evan Ward is the Head of the Department of Marine Sciences at the University of Connecticut. He was awarded a Ph.D. in Marine Biology and Biochemistry from the University of Delaware in 1989, receiving the College's E. Sam Fitz Award for greatest aptitude for professional development in marine studies. As a professor of marine sciences at UConn, Dr. Ward has been the recipient of a National Science Foundation Career Award and two Fulbright Foreign Scholarships. He has been a visiting scholar at the University of Panama (2004) and University of Exeter in England (2011). Dr. Ward also served as the lead Principal Investigator and director of NOAA's Oceans and Human Health training consortium in Connecticut which focused on interdisciplinary research and training in coastal-ecosystems & human Health. In 2013, he was elected to the Connecticut Academy of Science and Engineering. He has studied environmental physiology of marine, suspension-feeding invertebrates for over 30 years, and is a recognized world authority on the feeding processes of bivalve molluscs. Recently, Dr. Ward's research has focused on capture, ingestion and elimination of microplastics and nanomaterials by commercially important species, and the impacts of these particles on feeding and digestive processes. His research is funded by grants from the NOAA-Marine Debris Program, CT Sea Grant, Long Island Sound Study, and National Science Foundation. Dr. Ward has authored over 100 research papers, book chapters, and reviews, and serves on the editorial board of several scientific journals.

09:45 -10:15 AM

Dr. Cody Garrison

Assistant Professor
Department of Biology
SUNY Old Westbury

The Microplastic Problem through a Microbial Lens

Abstract

Microbes have adapted to utilize anthropogenic plastic polymers to their advantage. Highly urbanized coastal systems provide valuable opportunities for studying these adaptive microbial responses resulting from repeated exposure to concentrated plastic debris. Microplastic polymers (polyethylene, polystyrene, polycarbonate, polypropylene, polyethylene terephthalate, polyvinyl chloride) and glass bead controls were deployed at marine sites along an urban coastal contaminant gradient in Long Island, New York for 2 months to allow natural microbial colonization and utilization. Certain taxonomic groups (e.g., known plastic degraders), functional pathways (e.g., circular nitrogen cycling), and secondary metabolites (e.g., ectoine, Epsilon-poly-L-lysine, N-acetylglutaminylglutamine amide) were enriched on certain polymer types and at more urbanized sites. In addition, 32 novel bacterial lineages were recovered from non-redundant metagenome assembled genomes. Among those novel lineages, several hydrocarbon degrading taxa (i.e., putative plastic degraders) from the most urbanized site appear to be ubiquitously dispersed across a subset of global ocean metagenome samples. These results provide a greater understanding for how highly urbanized coastal systems can provide a platform for plastic-specific microbial adaptation and evolution that could affect marine biogeochemical cycling and dispersion of novel phenotypes on a global scale.

Dr. Cody Garrison is an Assistant Professor of Microbiology at SUNY Old Westbury. He is a microbial ecologist by training with a passion for studying the impact of critical global environmental issues on microbial and ecosystem function. Using a broad combination of genomic and culture-based methods, Dr. Garrison strives to understand microbial responses and adaptations toward anthropogenic forcings such as plastic pollution and climate change.

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10:25 -10:55 AM

Dr. Luis Ernesto Medina Faull

Lecturer and IDEA Fellow
Sustainable Climate Justice and Solutions
School of Marine and Atmospheric Science
Stony Brook University

From the Arctic to the Antarctic, Microplastics are pervasive in the Ocean

Abstract

Microplastics (MPs) have become an omnipresent component of the litter contaminating our oceans. These abundant micro-sized particles (diameters ranging from less than 0.001 to 5 mm) are either derived from the breakdown of larger plastic items or are intentionally manufactured (e.g., cosmetic microbeads, industrial pellets). Once entering the ocean through rivers, sewage discharge, and surface runoff, MPs move vertically and laterally along the coast and circulate into the open ocean. Oceanic MPs are problematic because they can bind toxic chemicals and enter the food chain. They are also possibly unintentionally included in fundamental studies of movement, chemical transformation, and storage of natural carbon in the ocean, all of which are integral to the study of climate change. To date, the effects of MPs on ocean carbon cycling measurements have not been evaluated systematically. In this presentation I will share the work developed to try to understand oceanic distributions of MPs using Raman microspectroscopy, and on determining the contribution of these synthetic polymers to natural organic particle pools. I will focus on how we established the abundance and distribution MP in different marine environments ii) how we computed realistic estimates of MP abundances to eventually derive a mass balance of oceanic MPs, and iii) evaluated how unintentional inclusion of MPs in carbon cycling measurements might distort our models of how the ocean processes natural carbon. Addressing these topics is crucial to understanding how plastic pollution has actually affected the ocean and biased our perceptions of how the ocean processes carbon..

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Dr. Luis Ernesto Medina Faull became a marine biologist in Venezuela at the Universidad de Oriente and obtained a Master's degree in Oceanography. He graduated from the Center of Excellence in Observational Oceanography at the Bermuda Institute of Ocean Science (Bermuda). In 2022 He obtained his Ph.D. in Marine Sciences from Stony Brook University. Currently, He is an IDEA fellow at the School of Marine and Atmospheric Sciences at Stony Brook University.

Dr. Medina Faull is a microplastic researcher with a strong background in marine microbial ecology and marine biogeochemistry, especially in oxygen-depleted and anoxic systems. He had the opportunity to work in the oxygen minimum zones in the North and South tropical Pacific and in the anoxic Cariaco Basin (Venezuela). He has been involved in numerous oceanographic cruises around the world and have gained experience in the use and maintenance of oceanographic equipment and research vessel operations. In his current research, Dr. Medina Faull is applying vibrational spectrometry techniques together with microbiology methods to assess microplastic pollution in the ocean and how these particles interact with marine organisms (fungi and bacteria) and affect the carbon biogeochemistry of the ocean.

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10:55 -11:25 AM

Ms. Huiping Deng

PhD Student
Lamont Doherty Earth Observatory
Columbia Climate School
Columbia University

Microplastic and Nanoplastic Exposure Through Tap Water

Abstract

As the production and consumption of disposable plastic products increase, plastic pollution has become a pressing environmental issue and public health concern. After being exposed to solar radiation, mechanical forces, and biological processes in the environment, plastics are broken down into microplastics (<5 mm), which can further fragment into nanoplastics (<1μm). Microplastics and nanoplastics (MNPs) have the potential to cross biological membranes, including lungs as well as the blood-brain barrier and placenta, adversely affecting human health. Our recent work showed that there are about 240,000 MNP particles in 1 liter of bottled water. However, MNP levels in tap water, another important pathway, have rarely been determined. To fill this important gap, this study leverages the wide geographic location of NIEHS-supported P30 centers and collects samples with the help of those centers. A sensitive technique, Stimulated Raman Scattering, will be used to provide insight into the distribution and types of plastic polymers found in collected tap water. Raman spectroscopy offers advantages in terms of nano-level sensitivity, chemical specificity, and high resolution of images.

Ms. Huipng Deng is a PhD student at Lamont-Doherty Earth Observatory of Columbia University. She is a co-author of the paper, Rapid single-particle chemical imaging of nanoplastics by SRS microscopy, which gave insight into the distribution of plastics in bottled water. After studying the exposure of plastics from bottled water, Ms. Deng is currently working on the distribution of plastics in tap water as well as snow samples from Antarctica, fish models and human samples.

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11:25 -11:55 AM

Dr. Ashok Deshpande

Research Chemist
Northeast Fisheries Science Center
Sandy Hook Laboratory
National Oceanic Atmospheric Administration

Characterization of Microplastics by Using a Novel Method of Pyrolysis GC-MS

Abstract

Plastics are contaminants of emerging concern that are accumulating at increasing rates in marine and freshwater ecosystems. Because of the sun and wave energies, the plastics break down into smaller particles, called microplastics of grain size lower than 5 mm. Microplastics also enter aquatic environments directly from a variety of sources, including cosmetics, synthetic clothing, and industrial processes. Microplastics are a cause for concern because their size range overlaps with the preferred particle size ingested by the animals at the base of the aquatic food webs. Different types of plastics exert different toxicities by themselves, and in addition, they adsorb different levels of chemical contaminants. The knowledge of polymer composition is therefore important in the understanding of sources and risk assessment. We tested the utility of a novel method of pyrolysis gas chromatography-mass spectrometry for the characterization of microplastic polymer types. In this method, a small piece of microplastic sample, less than 1 milligram in weight, is placed in a narrow quartz tube, which is then placed in a platinum coil and heated to 750 degrees C. The intense heat breaks down the large plastic polymer chains into smaller fragments. These fragments are then transferred to, separated on a gas chromatographic column, and identified using a mass spectrometer. The pyrolytic fragmentation patterns appear to be reproducible and unique to a given polymer type. The two-tier approach of peak fingerprints and mass spectra of the marker peaks provides higher confidence in the data quality. In addition to polymer typology, the presence of additives and other chemicals in the plastics can be determined in the analytical run. The proof-of-same concept of pyrolysis GC-MS was tested in a variety of new plastic items and in the weathered plastic samples from the littoral and aquatic environments.

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Dr. Ashok Deshpande has been working as a Research Chemist at NOAA Fisheries Northeast Fisheries Science Center Laboratory in Sandy Hook, NJ for about 30 years. Before joining NOAA, Dr. Deshpande was a research faculty at Virginia Institute of Marine Science/College of William and Mary, and a postdoctoral researcher at Eppley Institute for Research in Cancer and Allied Diseases/University of Nebraska Medical Center and Ohio State University.

Dr. Deshpande's research is focused on the applications of chemistry principles in addressing the baseline fisheries topics. These studies included the assessment of persistent chemical contaminants in the recreational and commercial fisheries resource species and the examination of potential uses of intrinsic and naturally embedded tracer chemicals in the assessment of habitat ecology, migratory behaviors, and predator-prey interactions. He has participated in various multidisciplinary studies involving government and academic scientists as well as high school, college, doctoral, and postdoctoral students. He actively collaborates with the faculty and students affiliated with the minority serving institutions. His recent interest is based on the characterization of microplastics polymers by using a novel technique of pyrolysis GC-MS. He has successfully analyzed a variety of hundreds of plastic samples from different littoral and aquatic environments, sea turtles, and seabirds.

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12:35 -01:05 PM

Dr. Matthew Campen

Distinguished Professor
College of Pharmacy
University of New Mexico

Silent Invasion:
The Remarkable Presence of Nanoplastics in the Human Body

Abstract

In recent years, the presence of plastics in major organs of the human body has been documented by laboratories around the world. Novel approaches have been developed to better quantify polymer solids with hopes of understanding the sources, mechanisms of uptake, distribution throughout the body, and ultimately the potential links to human disease. We have established a novel approach for pyrolysis gas chromatography mass spectrometry to provide quantitative assessments of the mass concentration of polymers in various tissues. Using both discarded tissues and decedent (autopsy) specimens, we have established a general comparative distribution of plastics in lungs, testes, placentas, liver, kidneys, and brains. Substantial accumulation has been noted in the brain, with average concentrations approaching 0.5% by weight (4800 μg/g), which is 10-20 times the levels in other organ systems. More strikingly, the concentrations of plastics in brain, liver, and lungs have significantly increased from a 2016 decedent cohort to a 2024 decedent cohort. These data along with a discussion of links to neurological and maternal/fetal health will be presented.

Dr. Matthew Campen has been a faculty member the University of New Mexico since 2009. He is a toxicologist with a background in air pollution, specifically focused on understanding how inhaled particulates drive health effects beyond the lung. He was trained at Virginia Tech (BS) the University of North Carolina (MSPH, PhD), and Johns Hopkins University (fellowship) before driving west to begin an independent research program at the Lovelace Respiratory Research Institute. He is the Director of the NIH/NIGMS-funded Center for Metals in Biology and Medicine and co-Director of the NIH/NCATS-funded Clinical and Translational Science Center at UNM.

01:05 – 01:35 PM

Dr. Huiyuan Guo

Assistant Professor
Department of Chemistry
Binghamton University

Tracking the Biological Barrier-Crossing Behavior of Nanoplastics

Abstract

Nanoplastics (nP) pose hazards to aquatic animals once they are ingested. Significant knowledge gaps exist regarding the nP translocation across the animal intestine, which is the first barrier between the ingested nP and the animal body. We examined the intestinal barrier crossing behavior of nP in an aquatic animal model (Daphnia magna) and determined the translocation mechanism with the help of model "core–shell" polystyrene nanoplastics (nPS) and confocal surface-enhanced Raman spectroscopy (SERS). The Raman reporter (4-mercaptobenzoic acid)-tagged gold "core" of the model nPS enables sensitive and reliable particle imaging by confocal SERS. The translocation was observed with the help of multilayer stacked Raman maps of SERS signals of the model nPS. With a higher concentration or longer exposure time of the model nPS, uptake and translocation of the plastic particles increased. In addition, we demonstrated that clathrin-dependent endocytosis and macropinocytosis were two major mechanisms underlying the translocation. This study contributes to a mechanistic understanding of nP translocation by using the pioneering model nPS and an analytical toolkit, which undergirds further investigations into nP behavior and health effects in aquatic species.

Dr. Huiyuan Guo received her Ph.D. from University of Massachusetts Amherst (2018) with a specialization in Environmental Chemistry and her B.S. from Beijing Normal University (2013) in Environmental Science. She worked as a postdoctoral associate in the Department of Civil and Environmental Engineering at Virginia Tech from 2018 to 2020 before joining SUNY Binghamton as an assistant professor in the fall of 2020. Her group is passionate about using advanced analytical tools and innovative materials to understand and protect natural and built environments, with the ultimate goal to improve environmental quality and public health.

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Driving Directions to Berliner Hall (#61 on the Map) at Hofstra University

- Exit Meadowbrook Parkway at M4 to Route 24 West (Hempstead Turnpike).
- Drive about one mile on 24W, passing the Nassau Veterans Memorial Coliseum.
- Turn left at the traffic light just before the second overhead walkway onto California Avenue.
- Berliner Hall is two blocks down at the intersection of California Avenue and Huntington Place.

GPS:

For GPS, enter "Berliner Hall - Hofstra University" or "906 Huntington Pl, Uniondale, NY 11553" as the destination.

Welcome to Hofstra! Visitor parking is available in any campus lot.