An Ocean of Microbial Molecules

Symposium on marine microbial and chemical ecology

Date & Time	Location	Registration by 20 January
26 January 2026 09:00-11:30	Technical University of Denmark Lyngby Campus, Building 101, S01	lbjbr@dtu.dk

Join us for “An Ocean of Microbial Molecules” on January 26th, 9:00–12:00 in Building 101, Room S01, where leading scientists will uncover the hidden chemistry of our oceans. Dr. Katherine Duncan explores antibiotic discovery from the deep sea using combined ‘omics approaches, revealing the chemical language of abyssal microorganisms. Dr. Catherine Bannon shares groundbreaking insights into Vitamin B12 dynamics in marine ecosystems, highlighting its role in microbial interactions and symbioses. Finally, Professor Paul Jensen introduces innovative techniques to access the ocean’s “chemical dark matter,” decoding metabolomes and discovering novel compounds with ecological and biomedical significance.

09:00-09:30 **Coffee, tea & networking**

09:30-10:10 **Antibiotics from the abyss – combined ‘omics biodiscovery from the deep-sea**

Katherine R. Duncan,
Senior Lecturer, Microbial Metabolomics & Antibiotic Discovery, Newcastle University, Biosciences Institute (NUBI)

10:10-10:50 **Vitamin Sea: New Insights into Cobalamin in the Ocean**

Catherine Bannon,

Postdoctoral fellow, Metabolische Interaktionen, Max-Planck-Institut für Marine Mikrobiologie

10:50-11:30 **Decoding the ocean metabolome one compound at a time**

Paul R. Jensen,
Professor of Marine Biology, Scripps Institution of Oceanography, University of California San Diego

Danmarks Grundforskningsfond
Danish National Research Foundation

Meet our invited speakers

In 2024, Kate moved to the Newcastle University (UK) and leads a team focussed on microbial metabolomics and antibiotic discovery. Prior to this Kate completed a Tenure-Track Chancellor's Fellowship at the University of Strathclyde in Glasgow (2016-2020) and was awarded full tenure to associate professor (2020-2023). Prior to starting her group, Kate completed two Postdoctoral Fellowships at Scripps Institution of Oceanography (California) in Marine Biomedicine and at The Scottish Marine Institute in Marine Biotechnology, a PhD in Biomedical Science (Canada) and a 5-year Masters in Chemistry (Aberdeen, Scotland) with International Placement (Florida). Kate is an advocate for community approaches to data sharing (ActinoBase, NPAtlas, MI-BiG, GNPS etc) and equality in STEMM. You can find out more about the Duncan lab at: www.medicinesfromthesea.com.

Dr. Catherine Bannon began a postdoctoral fellowship at the Max Planck Institute for Marine Microbiology in Bremen, Germany, in Fall 2024 after completing her PhD at Dalhousie University in Canada. Her research focuses on the functional roles of B-vitamins in ocean ecosystems, including marine microbial communities, harmful algal blooms, and in marine animal-microbe symbioses. She leverages mass spectrometry approaches to quantify vanishingly small pools of B-vitamins in the ocean, revealing how microbes produce, transform, and interact with these compounds, and identifying when and where these microbial metabolites have ecosystem-scale consequences. She is a passionate advocate for early career researchers and for elevating women in mass spectrometry.

Paul Jensen is a Professor at the Scripps Institution of Oceanography, Center for Marine Biotechnology and Biomedicine, University of California San Diego. His research interests lie at the interface of marine microbiology and natural products chemistry. His lab addresses fundamental questions such as what marine microbes produce natural products, where they live, why they make them, and how to better exploit them for useful purposes including drug discovery. While working with cultured microorganisms is an important aspect of this research, omic approaches are providing important new insight into the extent of microbial diversity in marine habitats, how effectively it has been accessed for natural product discovery, and how environmental metabolomes may shape community structure. His recent work includes new approaches to access "dark" chemical space from nature while his interests in chemical ecology have helped shape our understating of the roles of natural products in predation defense. Paul holds a Ph.D. degree from the Scripps Institution of Oceanography, an M.S. degree from San Diego State University, and a B.S. degree from the Florida Institute of Technology.

Danmarks Grundforskningsfond
Danish National Research Foundation

Abstracts

Antibiotics from the abyss – combined 'omics biodiscovery from the deep-sea

Dr Katherine R. Duncan
Senior Lecturer, Microbial Metabolomics & Antibiotic Discovery, Newcastle University, Biosciences Institute (NUBI)

The term "abyss" originates from the Greek word abyssos, meaning "bottomless," as ancient civilisations once thought the ocean was bottomless. We now define the abyssal zone as a depth of between 4,000 and 6,000 meters, characterised by perpetual darkness and 'marine snow'. This vastly understudied ecosystem covers over 80% of the total area of the oceans and 60% of the Earth's surface and is home to some of the most remarkable organisms, which we are only starting to understand. Last year, over 5,000 new species from a mineral rich area of the ocean floor called the Clarion-Clipperton Zone were described. It has long been known that bacteria can survive under these extreme conditions, with strains being isolated form hydrothermal vents and the deepest part of the ocean, the Mariana Trench. Here work will be presented where we target the isolation of spore-forming actinomycetes from the deep-sea and assess their natural product potential. We use combined 'omics methods to link biology (genes) to chemistry (antibiotics) with the aim to understand the 'chemical language' or these remarkable microorganisms and what influences it.

Vitamin Sea: New Insights into Cobalamin in the Ocean

Catherine Bannon
Postdoctoral fellow, Metabolische Interaktionen, Max-Planck-Institut für Marine Mikrobiologie

Vitamin B12, or cobalamin, has been recognized for decades as a microbially produced micronutrient with the potential to impact marine microbial community composition and activity in the ocean. But, how much do we truly understand about this essential metabolite? My research begins by addressing puzzling historical measurements of cobalamin in the sunlit ocean, providing quantitative evidence that
many previous estimates are unreliable. Instead, I present cobalamin form-specific photodegradation rates and novel photodegradation products that may influence microbial activity. Building on this, I will share mass spectrometry-based measurements of B-vitamins and related metabolites collected over five years in the Northwest Atlantic Ocean, demonstrating how such quantitative measurements can reveal real-time microbial community dynamics, including nutrient co-limitation and crucial community interactions. Finally, I will introduce my ongoing work on how marine animals acquire cobalamin, focusing on novel marine symbioses with low-complexity microbiomes to examine the functional impact of symbiotic B-vitamin production. This talk will synthesize recent advances in understanding cobalamin in the ocean and point toward exciting directions for future research.

Decoding the ocean metabolome one compound at a time

Paul R. Jensen
Scripps Institution of Oceanography, University of California San Diego

Marine microbes have proven to be a prolific source of novel natural products. Yet the compounds that have been discovered to date largely originate from the relatively few taxa that can be obtained in culture, suggesting that much of the ocean metabolome has yet to be accessed. This is supported by metagenomic analyses that reveal considerable, unrealized biosynthetic potential across marine microbiomes. Exploiting advances in environmental metabolomics, we have developed a Small Molecule In situ Resin Capture (SMIRC) technique to capture natural products directly from the environments in which they are produced. SMIRC deployments revealed significant differences in metabolomes across marine habitats and allowed us to isolate and characterized chemical scaffolds with unusual biological activities. These include a seagrass flavonoid with antibiotic properties that could have significant impacts on seagrass microbiomes and a new, cytotoxic carbon skeleton that is a common component of marine Dissolved Organic Matter and may mediate microbial interactions among plankton. Compounds captured using SMIRC can help resolve the chemical dark matter in the ocean, be used to explore chemically mediated interactions, and provide access to the biosynthetic potential of marine microbes without the need for upfront cultivation.

Danmarks Grundforskningsfond
Danish National Research Foundation