EnvEast Doctoral Training Partnership

How important are marine bacteria in DMSP cycling?

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Background: Dimethylsulfoniopropionate (DMSP) is one of Earth's most abundant organosulfur molecules. It is an antistress compound that was thought to be only produced by marine eukaryotes. However, we have shown that many marine bacteria also make DMSP as well as catabolising it and we have identified the key genes for both processes. When released into the environment, DMSP has important roles in global nutrient and sulfur cycling, signaling pathways and in climate, since DMSP catabolism can generate the climate-active gas dimethylsulfide (DMS). There are currently no molecular-genetic studies into DMSP synthesis by any organism or environment.

Project aims: -Study the role of bacteria in DMSP cycling over an annual cycle at Station L4, Plymouth
-Isolate and characterise model bacteria involved in DMSP cycling at L4.

Methodology: The student will use traditional sampling combined with molecular ecology techniques, including gene-probing and metagenomics, to study bacterial populations that both produce and catabolise DMSP in pelagic samples from the English Channel (www.westernchannelobservatory.org.uk) over a year-long study. The expression and abundance of the key DMSP synthesis and DMSP catabolic genes will be assayed by PCR-based techniques. DMS, DMSP and synthesis intermediates will be analysed by liquid chromatography/mass spectroscopy (LC/MS), and proton transfer reaction-mass spectrometry will be used to quantify rates of DMSP synthesis and catabolism**. T**he student will combine geochemical and molecular approaches to identify key bacteria that produce and catabolise DMSP, identify the key genes and cognate biochemical pathways that contribute to the flux of these influential molecules. Incubation experiments with eukaryotic and prokaryotic inhibitors will estimate the significance of bacteria in DMS/P production. Culture-dependent studies will be used to isolate model bacteria that make DMSP, enabling the investigation of conditions that affect DMSP production. This project will provide essential data to enable scientists to understand key biotransformations in the global sulfur cycle.

Training: The project involves expert training in molecular ecology and microbiology, bioinformatics and analytical chemistry. The student will undertake research in both UEA and Plymouth Marine Laboratory environments, as well as gain experience of working onboard a research ship during fieldwork in the coastal marine environment of L4.