

Project Title: Using environmental omics to explore the role of organic matter in freshwater ecosystems

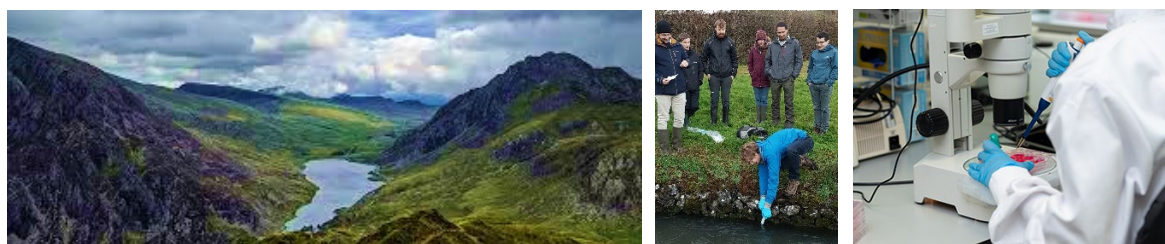
Lead Institution/Department: UK Centre for Ecology and Hydrology, and University of Bristol

Primary Supervisor: Dr Daniel Read, UK Centre for Ecology and Hydrology

Co-Supervisor: Dr Ellie Mackay, UK Centre for Ecology and Hydrology

Co-Supervisor: Professor Martin Genner, School of Biological Sciences, University of Bristol

Co-Supervisor: Professor Penny Johnes, School of Geographical Sciences, University of Bristol



Scholarship: A fully funded UKRI PhD studentship including UK fees, a tax-free stipend at the UKRI minimum rate (£19,237 in 2024-25) and a full UKRI Research Training Support Grant (RTSG) to support project costs, training and travel is available, linked to a major UKRI funded programme led by the University of Bristol. Study will begin in September 2025 and is funded for four years. The deadline for applications is 31st March 2025.

Project aims and methods

We are seeking a candidate passionate about freshwater ecosystems and microbiology for an exciting PhD opportunity to investigate the interaction between microbes and dissolved organic matter. This studentship comes with 4 years funding and a full UKRI Research Training Support Grant. The PhD is part of the large, five-year, European Research Council-funded REFRESH project at the University of Bristol, led by Professor Penny Johnes, to research the role of dissolved organic matter (DOM) as a nutrient resource in freshwater systems¹.

Rivers and streams play a vital role in the global carbon cycle, receiving at least 2,800 Mtonnes C/year from terrestrial ecosystems and delivering 1,000 Mtonnes C/year to the oceans. DOM is a major component of this carbon flux, with microbial utilisation of DOM for growth and respiration (the 'riverine bioreactor'), considered one of the dominant pathways controlling its fate in rivers. Respiration by bacterioplankton is a major contributor to the processing of organic matter. These free-floating and particle-associated organisms consume and degrade organic matter, releasing an array of compounds and metabolites as DOM during cell growth, division, and death. These compounds are progressively utilised and produced by other microbial community members, providing a feedback loop between microbial production of DOM and the role of DOM composition in shaping community taxonomy and function.

In this project, you will use cutting-edge molecular microbiology (omics) and experimental approaches to identify key freshwater microorganisms involved in DOM utilisation and transformations, focusing on both the C and N utilisation in differing DOM molecules. You will have access to state-of-the-art molecular ecology laboratories at both the host institute (UKCEH Wallingford) and the University of

Bristol, including next-generation DNA sequencing, high-performance computing, flow cytometry/sorting, as well as high-resolution molecular microscopy and the organic geochemistry laboratories at the University of Bristol for any high resolution mass spectrometry work, in collaboration with other team members.

Key research activities will include: (1) Setting up and running freshwater bioreactors and/or microcosms to mimic microbial freshwater ecosystems; (2) Dosing bioreactors with a range of dissolved organic matter compounds representing different biochemical classes of DOM of varying molecular structures and degradability; (3) Using Bioorthogonal non-canonical amino acid tagging (BONCAT)² to label physiologically active cells and flow sorting to sort these populations into separate fractions; (4) Using next-generation sequencing and bioinformatic analysis of DNA sequence data to identify taxa that respond to different forms of DOM, as well as characterising their functional properties; (5) Integrating results with broader project objectives on DOM cycling and ecosystem function; and (6) Working closely with the wider REFRESH team of investigators, postdoctoral researchers and research technicians on joint experiments, including another PhD student on the project studying isotopic approaches to identify DOM utilisation with a particular focus on P uptake, and another PhD student who will be developing novel targeted analytical methods for molecular scale quantification of DOM molecules in freshwaters.

1. Johnes, P. J., Evershed, R. P., Jones, D. L., & Maberly, S. C. (2023). Exploring the nature, origins and ecological significance of dissolved organic matter in freshwaters: state of the science and new directions. *Biogeochemistry*, 164, 1–12.
2. Kasteren, S. van, & Rozen, D. E. (2023). Using click chemistry to study microbial ecology and evolution. *ISME Communications*, 3, 9.

Training and skills:

You will have access to state-of-the-art analytical facilities and training in molecular microbiology (both wet lab and bioinformatics), as well as access to a wide range of core skill training at the host institution (UKCEH) and at the University of Bristol. You will also gain experience working within a large, multidisciplinary research team, with opportunities to collaborate with international partners and present at national and international conferences.

This project will be supervised and led by [Dr Daniel Read](#) and [Dr Ellie Mackay](#) at UKCEH and co-supervised by [Prof. Martin Genner](#) in the School of Biological Sciences and [Prof. Penny Johnes](#), the programme lead at the University of Bristol, and the degree will be awarded by the University of Bristol. The student will benefit from collaboration with project partners across multiple institutions and will join a dynamic research environment at UKCEH but will also spend time at the University of Bristol to take advantage of training and research opportunities and facilities.

Candidate Requirements

The successful candidate will be expected to meet the following criteria:

- Hold or expect to obtain at least a first-class or upper second-class honours degree providing knowledge and skills in Molecular Biology, Microbiology, Environmental Biology or Ecology
- Have good laboratory skills and experience in molecular biology and omics techniques
- Demonstrate excellent organisational and time management abilities

- Show enthusiasm for field-based research and willingness to conduct sampling in various weather conditions
- Have good mathematical and statistical skills

Useful Links

For informal enquiries, please contact the lead supervisor, Dr Daniel Read (daniel.read@ceh.ac.uk).

How to Apply: please apply through the following link, selecting the Geography (PhD) option at <https://www.bristol.ac.uk/study/postgraduate/apply/>

Application deadline: 31 March 2025