**PROJECT TITLE:** What can the microbiome tell us about expanding ocean dead zones?

**DTP Research Theme(s):** Living World, Changing Planet

**Lead Institution:** University of Bristol

**Lead Supervisor:** Dr Patricia Sánchez-Baracaldo, School of Geographical Sciences, University of Bristol

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**Project keywords:** metagenomics, oceanography, climate change, microbiology

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**Figure 1.** Dissolved oxygen concentration in low-oxygen zones of the global ocean (Bollman et al., 2010)

**Project Background**

Oxygen is essential for life. Global warming and increased nutrient inputs have reduced the amount of dissolved oxygen in the ocean by more than 2% since the 1960s (Schmidtko et al., 2017), and vast naturally occurring low-oxygen “dead zones” have expanded (Brietburg et al., 2018). Low-oxygen zones in the open ocean play host to diverse microbial communities which drive the cycling of nutrients and energy. Recent ship-borne expeditions provide a wealth of new information about microbial assemblages within low-oxygen zones (Sunagawa et al., 2015). These data offer an exciting opportunity to study the key metabolisms indicative of the health of the oceans, and for understanding how low-oxygen areas may respond to present and future climate change.

**Project Aims and Methods**

The overall aim of this project is to combine genomic data with biogeochemical modelling to enhance our understanding of oxygen starved regions in the ocean. This project aims to study the global distribution of oxygen-based metabolisms mediated by microbes. The student will mainly employ comparative analyses using genomic data to determine the distribution of key microbial communities (e.g., gene structure, gene content). Genomic data (e.g. TARA oceans, Sunagawa et al. [2015]) will be used to identify the key metabolic markers of ocean dead zones. Analysis of genomic data collected from ocean time series stations within low-oxygen areas, such as the Bermuda-Atlantic Time-series Study (BATS, Biller et al. [2018]), will also be used to assess time varying microbial dynamics. Genomic data will be used in combination with biogeochemical modelling to assess the expansion of these zones across different regions of the ocean.
Candidate Requirements
At least a 2.1 (Hons) degree or equivalent in a relevant quantitative subject, e.g. microbiology, bioinformatics, population genomics, environmental biotechnology, genetics, genomics, and computer science. The project would suit a candidate with a strong background in computational biology or modelling. Experience of computer programming and analysis of large datasets is highly desirable. This is a great opportunity for students interested in marine biology, genomics and climate.

Training
By the end of the PhD program student will have learnt comparative genomics, molecular evolution and biogeochemistry. The student will be trained in computer programming (Shall Scripting, R Scripting, and either PERL or Python), bioinformatics and phylogenetics. The project is highly interdisciplinary and the student will have the opportunity to apply their work on genomics and apply it modelling marine biogeochemical cycles and climate impacts using Earth System Models. The student will have the opportunity to attend relevant international conferences, summer schools, and workshops according to their interests.

References / Background reading list

Links:
School URL –
http://www.bristol.ac.uk/geography/courses/postgraduate/

NERC GW4+ DTP Website:
http://nercgw4plus.ac.uk/

Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2019/doctoral/phd-great-western-four-dtp/

Application deadline: 16:00 GMT, Monday 7 January 2019
How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

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