

## **Fate, transformation and effect of microplastics on microbial communities in the environment.**

### **Supervisory Team**

Dr Corinne Whitby ([cwhitby@essex.ac.uk](mailto:cwhitby@essex.ac.uk)) - School of Biological Sciences, University of Essex  
Dr Philippe Laissue ([plaissue@essex.ac.uk](mailto:plaissue@essex.ac.uk)) – School of Biological Sciences, University of Essex  
Prof Richard Thompson ([R.C.Thompson@plymouth.ac.uk](mailto:R.C.Thompson@plymouth.ac.uk)) – University of Plymouth  
Dr Andrew Mayes ([Andrew.Mayes@uea.ac.uk](mailto:Andrew.Mayes@uea.ac.uk)) - University of East Anglia  
Dr Lucinda Gilfoyle ([LGilfoyle@anglianwater.co.uk](mailto:LGilfoyle@anglianwater.co.uk)) - Anglian Water

### **Scientific background**

Microplastics can enter ecosystems, where they affect microorganisms and their processes. Microbial-driven nitrogen (N) cycling is fundamental in the environment, yet little is known how microplastics affect these key microorganisms. Microplastics also occur in waste biosludges, with potential impacts to N-removal. Furthermore, the majority of biosludges are used as fertilisers, where there is risk to agricultural soils. Currently, there is virtually nothing known about the fate, transformation and effects of microplastics on microbial communities in the environment, especially where N-cycling is important.

### **Aims:**

1. Characterise the effect of microplastics on microorganisms, specifically those involved in N-cycling.
2. Characterise the fate and biotransformation of microplastics in the environment.

### **Research Methodology**

The student will conduct field sampling (sediments, biosludges, agricultural soils) and apply molecular, chemical and analytical techniques to characterise the effect of microplastics on microbial communities and N-cycling. Manipulation experiments will also be performed to encompass seasonal/ environmental variations (e.g. temperatures, nutrient inputs). Polymer transformation will be measured by changes in size/physical appearance, and spectroscopic signatures (UEA). At Essex, microbial communities will be characterised using qPCR, amplicon sequencing targeting phylogenetic (bacteria/archaeal 16S rRNA) and N-cycle genes (e.g. amoA, nitrifiers; nirS, denitrifiers) and related to potential rates (e.g. nitrification, denitrification). Fluorescence microscopy and FISH will also be performed to characterise biofilm formation and determine the spatial distribution of microorganisms on microplastics.

### **Training**

The candidate will join the Ecology and Environmental Microbiology Group at Essex with further training at UEA, Plymouth and Anglian Water. Training will include fieldwork, qPCR, high throughput sequencing, bioinformatics to characterise microbial communities. Bioimaging (fluorescence/electron microscopy) to measure biofilm formation and analytical chemistry (synthesis, FT-IR spectroscopy) to quantify polymer transformation. The student will also spend three months at Anglian Water and gain business experience and skills in resource based management. The student will have access to training courses across institutes.

### **Person specification**

A highly motivated student with a background in Microbiology, Biochemistry, Environmental Sciences or related discipline, who is keen to learn new skills and engage with industry. The candidate will have good communication skills and be self-motivated. For scientific enquiries contact [cwhitby@essex.ac.uk](mailto:cwhitby@essex.ac.uk).

### **References**

Johnson R, Smith BE, Sutton PA, McGenity TJ, Rowland SJ, Whitby C (2011) Microbial biodegradation of aromatic alkanolic naphthenic acids is affected by the degree of alkyl side chain branching. ISME J 5:486-496

Beddow J, Stolpe B, Cole PA, Lead JR, Sapp M, Lyons BP, Colbeck I, Whitby C (2017). Nanosilver inhibits nitrification and reduces ammonia-oxidizing bacterial but not archaeal amoA gene abundance in estuarine sediments. Environ Microbiol 19:500-510.

Chansawang N, Geider RJ, Obara B, Laissue PP (2016). Three-dimensional visualisation and quantification of lipids in microalgae using fluorescence microscopy. Hydrocarbon and Lipid Microbiology Protocols (eds McGenity T, Timmis K, Nogales B). Springer, New York, pp 145-161.

Law KL, Thompson RC (2014). Microplastics in the seas. Science 345:144-145.

Maes T, Jessop R, Wellner N, Haupt K, Mayes AG (2017) A rapid-screening approach to detect and quantify microplastics based on fluorescent tagging with Nile Red. Scientific Reports 7:44501.

### **Key Information**

- This project has been shortlisted for funding by the ARIES NERC Doctoral Training Partnership ([www.aries-dtp.ac.uk](http://www.aries-dtp.ac.uk)).
- Successful candidates who meet UKRI's eligibility criteria will be awarded a NERC studentship - in 2018/19 the stipend is £14,777.
- Undertaking a PhD with ARIES will involve attendance at training events.
- ARIES is committed to equality & diversity, and inclusion of students of any and all backgrounds. All ARIES Universities have Athena Swan Bronze status as a minimum.
- Applicants from quantitative disciplines who may have limited environmental science experience may be considered for an additional 3-month stipend to take appropriate advanced-level courses.
- Usually only UK and EU nationals who have been resident in the UK for 3 years are eligible for a stipend. The closing date for applications is 23:59 on 8<sup>th</sup> January 2019. Shortlisted applicants will be interviewed on 26<sup>th</sup>/27<sup>th</sup> February 2019

### **How to Apply**

Please apply by sending a CV (including contact details of two academic referees) and a cover letter explaining your motivation and suitability for the PhD to Emma Revill [ariesapp@essex.ac.uk](mailto:ariesapp@essex.ac.uk) by 8<sup>th</sup> Jan 2019. If you have any questions please feel free to contact any member of the supervisory team.

