

# Research Experience Placement (REP) Scheme 2026

## Supervisor Project Proforma

<b>Project title:</b>	Biomolecular Transformation of Heavy metals on Micro-nanoplastics
<b>Host Institution:</b>	University of Birmingham, UK
<b>Project supervisor (name, department):</b>	Dr Swaroop Chakraborty, School of Geography Earth and Environmental Sciences
<b>Project enquiries (supervisor email):</b>	s.chakraborty@bham.ac.uk
<b>Co-Supervisor, if any (name, department):</b>	
<b>Proposed start date and weekly hours:</b> (please note project must be of 6 weeks duration)	6 <sup>th</sup> July to 17 <sup>th</sup> August (6 weeks), 36 hours per week
<b>Please provide a short paragraph or couple of sentences summarising the project to encourage potential applicants to apply (max 75 words):</b>	
<p>Micro- and nanoplastics can interact with toxic metals in water and may alter how these contaminants move through the environment and affect aquatic life. In this hands-on 6-week project, the student will investigate how biomolecularly conditioned plastic particles bind selected heavy metals, gain training in laboratory and analytical techniques including mass spectrometry, and explore potential effects on the freshwater organism <i>Daphnia magna</i>.</p>	
<b>Project description (max 700 words, 1-2 figures may be included):</b>	
<p>Micro- and nanoplastics are now recognised not only as pollutants, but also as chemically active surfaces that can interact with metals and other contaminants in aquatic environments. Once these particles enter water, their surfaces can rapidly change through contact with natural organic matter and biomolecules, altering how they behave and what they carry. Recent research suggests that such surface changes may influence how strongly plastics bind potentially toxic elements and may also affect contaminant mobility, bioavailability, and toxicity.</p> <p>This 6-week undergraduate summer placement will provide a practical introduction to this emerging area of environmental science. The student will investigate how a selected micro- or nanoplastic interacts with one or two model heavy metals under simple freshwater laboratory conditions, and whether these interactions may influence short-term toxicity in the freshwater invertebrate <i>Daphnia magna</i>. The project is designed to be manageable within the timescale of a CENTA REP placement while still giving the student direct experience of real environmental chemistry and ecotoxicology research.</p> <p>The main objective of the project is to assess whether biomolecularly conditioned plastic particles alter the concentration and short-term biological effects of selected heavy metals in freshwater. To keep the project feasible, the student will work with a simple experimental design comparing a small number of treatments, for example: metal only, plastic only, and metal plus plastic. Where possible, a straightforward biomolecular conditioning step will be included, such as pre-incubation</p>	

of particles in a natural organic matter-containing medium, to provide a simple model of environmentally relevant surface transformation.

**The student will receive training and participate in:**

preparing plastic suspensions and metal exposure media; carrying out batch adsorption experiments; assisting with sample preparation for mass spectroscopic analysis; learning how dissolved metal concentrations are measured; supporting a short, supervised *Daphnia magna* exposure study; analysing data using spreadsheets and graphs; and discussing findings in the context of environmental pollution and risk.

The project will provide a strong laboratory-based experience rather than being purely desk-based. The student will spend most of the placement in the laboratory learning core experimental skills, while also taking part in group meetings, discussions, and informal training activities within the research team. This will help them understand how environmental research is designed, conducted, interpreted, and communicated.

The project addresses an important environmental question: do micro- and nanoplastics behave as passive carriers of contaminants, or can changes at their surface modify metal interactions and downstream biological effects? This idea is increasingly important in current discussions of plastic pollution, particularly because biofouled or chemically conditioned plastics may behave very differently from pristine laboratory particles.

By the end of the placement, the student will have generated a small but useful pilot dataset and developed experience in environmental analytical chemistry, ecotoxicology, and data interpretation. The student will also be encouraged to think independently about experimental design, limitations of simplified laboratory systems, and the wider implications of pollutant interactions in freshwater ecosystems. The placement will conclude with a short-written summary and an informal presentation to the research group. The student's work will contribute to a future manuscript arising from the project, and they will be included as a co-author in recognition of their contribution.

**Project timeline:**

**Week 1:** Induction, health and safety training, background reading, introduction to micro/nanoplastics, heavy metals, and *Daphnia magna*; laboratory training.

**Week 2:** Preparation of stock suspensions and exposure media; preliminary plastic-metal interaction experiments; training in contamination control and sample handling.

**Week 3:** Batch adsorption experiments and sample collection; preparation of samples for mass spectrometry analysis; introduction to data recording and plotting.

**Week 4:** Repeat/optimize selected experiments; begin analysis of adsorption data; set up supervised short-term *Daphnia magna* exposures.

**Week 5:** Complete biological observations and analytical measurements; compare control, metal-only, and metal-plus-plastic treatments.

**Week 6:** Data analysis, interpretation, figure preparation, short report writing, and informal presentation to the research group.

**Candidate requirements:**

This project would suit an undergraduate student in environmental science, chemistry, biology, toxicology, or a related discipline.

The student should have:

- an interest in environmental pollution and aquatic systems;
- enthusiasm for hands-on laboratory work;
- willingness to learn new analytical and biological techniques;
- careful approach to experimental work and record-keeping;
- basic confidence in handling data in Excel or similar software.

Previous laboratory experience is welcome but not essential, as full training will be provided.

**Background reading and references:**

Chakraborty, S.; Drexel, R.; Bhadane, P.; Langford, N.; Dhupal, P.; Meier, F.; Lynch, I. **An Integrated Multimethod Approach for Size-Specific Assessment of Potentially Toxic Element Adsorption onto Micro- and Nanoplastics: Implications for Environmental Risk.** *Nanoscale* 2025, 17, 9122–9136.

Rodrigues, J. P.; Duarte, A. C.; Santos-Echeandía, J. **Interaction of Microplastics with Metal(Oid)s in Aquatic Environments: What Is Done so Far?** *Journal of Hazardous Materials Advances* 2022, 6, 100072.

Liu, G.; Dave, P. H.; Kwong, R. W. M.; Wu, M.; Zhong, H. **Influence of Microplastics on the Mobility, Bioavailability, and Toxicity of Heavy Metals: A Review.** *Bulletin of Environmental Contamination and Toxicology* 2021, 107, 710–721.

Yang, H.; Chen, Z.; Kong, L.; Xing, H.; Yang, Q.; Wu, J. **A Review of Eco-Corona Formation on Micro/Nanoplastics and Its Effects on Stability, Bioavailability, and Toxicity.** *Water* 2025, 17, 1124.

Permana, R.; Chakraborty, S.; Valsami-Jones, E. **Nanoplastics in Aquatic Environments: The Hidden Impact of Aging on Fate and Toxicity.** *Environmental Chemistry and Ecotoxicology* 2025, 7, 429–444.

To be completed by institutional CENTA PoC

I confirm that:

- The host institution takes responsibility for selecting a suitable undergraduate student and ensuring and confirming their eligibility under the NERC REP student eligibility criteria.
- This REP project falls within the NERC remit, is of suitable quality and meets the REP research project criteria.
- Appropriate supervisory arrangements are in place.



- The application processes used will be inclusive and accessible.
- Reasonable adjustments will be made for students that need them whilst undertaking placements.
- The placement will be carried out in accordance with all applicable ethical, legal and regulatory requirements including but not limited to relevant provisions of the General Data Protection Regulation, the Data Protection Act 2018, the Bribery Act 2010, the Fraud Act 2006, the Equality Act 2010 and the Modern Slavery Act 2015.
- The host organisation takes responsibility for identification, protection and exploitation of any intellectual property rights arising from the work.
- All facilities, agreements about access and collaborations necessary for the work will be obtained before the work commences and can be ensured through the period of the work.
- All costs awarded by NERC for the REPs will be used and accounted for appropriately.
- A report of the project by the student will be submitted no later than one week after the end date of the placement or Friday 25<sup>th</sup> September 2026, whichever falls first.
- A PhD interview (where possible) will be offered to all students who have completed a REP within the CENTA Doctoral Landscape Award.

A handwritten signature in black ink that reads 'Sam Matthews'.

Signed:

Date: 22/03/26

Position: CENTA PoC (Uni. of Bham)