

PhD Project Advertisement

Project title: *Mapping the farmscape of antibiotic resistance: metagenomes, antibiotic resistance genes, and mobile genetic elements*

Project No: FBS25-14-Wheatley-qa

Lead supervisor: Dr Rachel Wheatley, School of Biological Sciences, Queen's University Belfast

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Co-supervisors:

Dr Arwyn Edwards, Department of Life Sciences, Aberystwyth University

Dr Selvakumar Dhandapani, Biogeochemistry and Terrestrial Ecology, Agri-Food and Biosciences Institute (AFBI)

Dr Linda Oyama, School of Biological Sciences, Queen's University Belfast

Project description: Antibiotic resistance poses a significant risk to human health, as the effectiveness of antibiotics used to treat bacterial infections is increasingly compromised. Antibiotic resistance genes ("ARGs") are genes possessed by bacteria that confer resistance to antibiotics. This resistance may be provided through a number of different mechanisms, including via the production of antibiotic-inactivating enzymes or through promoting the efflux of antibiotics from the cell.

We are increasingly recognising the need for monitoring of antibiotic resistance genes in the environment. This includes in agricultural soils, which have the potential to serve as reservoirs of antibiotic resistance in food producing animals. In these environments, the dissemination and propagation of resistance genes may be influenced by several biological and environmental factors, including land-use, contact with humans or animals, biogeochemical properties of the soil, and the soil microbiome. Understanding the diversity, abundance, and transfer and selection mechanisms of antibiotic resistance genes in agricultural soils is a pressing research challenge, and one that will inform on our ability to combat antibiotic resistance in food systems.

Project aims:

This project will work with a unique and exciting dataset from the Agri-Food and Biosciences Institute (AFBI) where soil samples have been collected to a metre depth from farmland sites across Northern Ireland. These samples are currently unexplored with regards to the soil microbiome and their role as reservoirs for antibiotic resistance genes.

This project will use this collection to address three major aims:

Aim 1: How do varied biological and geographical factors relate to the diversity and abundance of antibiotic resistance genes within farmland soils?

Aim 2: Which mobile genetic elements are associated with the dispersal of antibiotic resistance genes across farmland soils?

Aim 3: What sort of genes do antibiotic resistance genes co-occur with and why?

Overall, this project aims to advance our understanding of antibiotic resistance gene dynamics in agricultural soils. The successful student will develop a strong microbiological and bioinformatics skillset with cutting-edge skills in metagenomics, along with highly transferable computational skills in handling complex datasets and conducting statistics. The project is supported by research leaders with expertise across evolutionary biology, microbial ecology, environmental microbiology, and soil biogeochemistry, with interdisciplinary teams across Queen's University Belfast, Aberystwyth University, and AFBI, an agricultural research leader in Northern Ireland.

Training opportunities: Training in bioinformatics, metagenomics, statistics, and in understanding varied microbiological, ecological, and biogeochemical data will be provided across the course of the project. The project will primarily be based at Queen's University Belfast in the Wheatley group, but student will have the opportunity to spend 2-3 months in

Aberystwyth in the second year to learn advanced mobile genetic element and plasmid methodology in the Edwards group.

Project supervision plan: The student will meet for a 1:1 meeting with the lead supervisor every 2 weeks. These will be more frequent (once a week) at the start of the PhD or when more support is needed. Group meetings in the lead supervisors group are every 2 weeks, so in general weeks will alternate between a 1:1 meeting and the group meeting. The lead supervisor (RW) has an 'open door' policy, facilitating questions and communications on an ad-hoc basis when needed. The student will meet with the wider supervisory team every 6 weeks (so every 3rd 1:1 meeting with the lead supervisor). The student will have opportunities to present in and be invited to attend particularly relevant group meetings of the supervisory team.

Student profile: We seek candidates with a background in biological sciences including bioinformatics, environmental biology, genetics and microbiology.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion:

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups.

These are an opt-in processes.

Our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).