FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-43-Farrar: The role of the microbiome and epigenetics in plant resilience Lead supervisor:

Supervisor:
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Project description:

Plant resilience is fundamental to crop production in the 21st century as weather patterns vary from season to season and extreme events become more frequent due to climate change. Yield increases, gained through plant breeding and improvements to agronomy, have slowed in recent years, while plants face new challenges from droughts and flooding. Our understanding of the plant genome and its regulation has improved considerably since the original models of gene to transcript to protein were developed, and now incorporates epigenetic modification as well as the interaction of the plant with its microbiome. Despite each component having been well studied, little has yet been done to integrate them to provide a holistic understanding of how the plant and its microbiome respond to environmental stresses. **We propose that these systems are integrated and may be optimised in order to improve plant resilience to drought and waterlogging.**

The Farrar lab has collections of endophytic bacteria isolated from plant tissues from a range of challenging environments and pre-screened for plant growth promotion under control and abiotic stress conditions. **Plants will be grown with and without water stress, with and without beneficial bacteria to determine the mechanism by which these plant-microbe interactions benefit the plant.** This builds on work in the Farrar lab demonstrating that a novel halotolerant bacterial endophyte isolated in our lab mediates abiotic stress tolerance with minimal transcriptional modifications in *Brachypodium distachyon*, a grass species with a small genome which is an ideal model for the C3 grain crops.

We will develop Oxford Nanopore technology (ONT) for rapid sequencing at low cost to enable fast and agile data capture. **We will optimise both technical and bioinformatic pipelines for the rapid, responsive, and cost-effective analysis of the plant transcriptome, epigenome and microbiome, and use these to analyse and integrate the responses of the different components to successive drought and waterlogging events.** As ONT sequencing develops, there is an unmet need for tools for rapid and reproducible research-grade nanopore sequencing. We will develop a hybrid wet & dry solution for analysing plant transcriptomes, microbiomes and epigenomes to better understand the effects of environmental stresses on plants.

The overall aim of project is to develop and apply cost effective protocols to analyse and integrate aspects of plant biology generally considered in isolation. We will use the model grass *Brachypodium distachyon* due to its small genome size, tractable lifecycle and its direct relevance to food, feed and energy crops.

Training opportunities:

The student will receive world-class training in several diverse disciplines. At IBERS Aberystwyth University, they will utilize and be trained in microbiology, bacterial genome sequencing, and bioinformatics. They will also have the opportunity to go on a Professional Internship as part of AberInnovations. Training in crop biology, plant biochemistry, and mass spectrometry techniques will be provided at the University of Reading.

The student will gain an ***interdisciplinary*** *training in* ***microbiology, plant science, plant-microbe interactions, epigenetics, microbial community analysis and bacterial genomics*** *with emphasis on* ***experimental design and data analysis****. Further, the student will develop* ***informatics skills*** *by receiving training in* ***genomics*** *and learning various* ***statistical and bioinformatics tools*** *at Cranfield University. Additional training will include participating in the* ***SysMic online training in maths and computing for the bioscience community****. The project has direct relevance to* ***Agriculture and Food Security****. The student will join a group working at the* ***academic-industrial interface*** *producing* ***high quality science with real world application****.*

Student profile:

Students should hold a minimum BSc (2:1) and/or MSc in agriculture, plant science, microbiology, genetics, bioinformatics, or a related degree subject. Good communication, writing, organizational, and critical thinking skills will be essential. Previous work experience in microbiology and with bioinformatics analysis are highly desirable.

Funding Note

This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply

Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.