PhD Project Advertisement

Project title: Meta-omics of the rumen through RNA interaction networks
Project No: FBS2023-23-Hart-aq

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Project description:

Ruminant livestock enable the conversion of low nutritional plant material into useful meat and milk products for human consumption. With the global increase of the human population predicted to rise to 9.1 billion by 2050, food production will need to increase considerably to meet these demands. The rumen is a complex and dynamic environment containing a multitude of synergistic microbiota that enable ruminants to utilise plant material. However, it is an inefficient system in terms of productivity and contributes to large environmental costs, such as the emission of greenhouse gases. Extracellular (ex)RNAs (including miRNAs) have the potential to modulate host microbe interactions. However, very little research has so far been conducted assessing the impact of exRNAs on the rumen microbiome. Understanding of how these modulatory mechanisms influence microbiome function through various interactions with rumen microbiota will be key to the development of improving rumen efficiency, lowering environmental impact and improving livestock health and wellbeing. The analysis of changes within the rumen microbiome in terms of species composition and protein/gene expression, and isolating exRNAs present in rumen fluid will be conducted with the aim to add depth to the understanding of the complex rumen environment. Thereby, improving ruminal function in terms of forage utilisation efficiency, reducing negative environmental outputs and assessing the impact of potential gut dysbiosis from pathogens and their treatment, on ruminal productivity. Using a multi-omic approach, datasets will be created for in-depth cross analysis of the rumen microbiome. Bioinformatics and RNA network analysis will aim to identify interactions between exRNAs and transcripts within the bacterial meta-transcriptome, and how this links to changes in the meta-proteome and the microbiome. Following on from this we will investigate the impact of plant and pathogen exRNAs on RNA-based interaction networks in the rumen, which will provide the first data on the impact of plant and pathogen exRNAs on rumen RNA and protein interaction networks within the ruminal microbiome.

Training opportunities:

This project will provide specialist and exciting training opportunities for the successful candidate in a range of 'omics techniques including meta-genomics, meta-transcriptomics and meta-proteomics. The student will receive training in leadership, research skills, bioinformatics and public engagement (e.g. attendance at the Royal Welsh Show). Training at Aberystwyth University will involve meta-genomics and meta-proteomics skills as well as in vitro fermentation and other laboratory techniques relevant for the post. Placement will also be provided at Queens University Belfast for short periods of time during the year, where students will undertake training in RNA extraction, and in silico methods including command-line bioinformatics, and RNA-Seq analysis pipelines. Flexibility around planned work placements will be available as well as flexibility for students who require part-time study.

Student profile:

Undergraduate degree (2:1 or higher) in Biological Sciences or similar; Or 2:2 at undergraduate level with an MSc in a biological science discipline. Relevant research experience would be beneficial.

Knowledge and understanding of livestock health and biology and/or livestock pathogen biology , with some research laboratory experience relating to molecular biology techniques.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year.

For 2022/23 this will be £17,668 and this will increase slightly each year at rate set by UKRI.

Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, 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.

In accordance with UKRI guidelines, 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.