PhD Project Advertisement

Project title: Exploring Bovine TB epidemiology on persistently infected farms via enhanced molecular analysis of the environment and parasitic nematode populations

Project No: FBS2024-063-JonesR-ar

Lead supervisor: Rhys Jones, Life Science, Aberystwyth University

Email: raj22@aber.ac.uk

Co-supervisors:
Ian Jones, University of Reading
Amanda Gibson, Aberystwyth University
Glyn Hewinson, Aberystwyth University

Project description:

Bovine tuberculosis (bTB) is amongst the most pressing issues facing the UK livestock industry. This chronic infectious cattle disease, which can also transmit to humans, cost the UK economy £100 annually, with over 30,000 cattle culled due to bTB in the UK in 2022. As such, bTB severely impacts the viability of cattle production systems in endemic areas and causes a significant strain on the wellbeing of cattle producers in England and Wales. With successful eradication of this disease imperative to protect animal, human and economic health and wellbeing, the UK and Welsh governments have implemented stringent testing and control measures to curb the spread of bTB over recent decades. However, bTB has remained stubbornly prevalent and further research is needed urgently to improve our knowledge and understanding of bTB epidemiology to enable informed future control policies that will lead to its successful eradication.

One specific area of bTB epidemiology where knowledge remains lacking is the role of the environment in the persistence and transmission of bTB on farms. Fortunately, significant progress has been made within the field of molecular environmental analysis in recent years, with environmental DNA (eDNA) analysis already revolutionizing the detection and monitoring of organisms within the environment in ecological, human and veterinary health settings. This non-invasive technique can offer significant insight into disease spread and has great potential in determining transmission routes on farms in a cost-effective and efficient manner which can lead to the application of optimal farm management strategies to reduce bTB transmission risk. However, its application in bovine TB epidemiology has thus far been limited.

Furthermore, there is increasing evidence of interaction between bovine TB and parasitic helminths. Specifically, microbiome analysis of infectious nematodes has revealed that pathogenic Mycobacteria spp. may be harboured within these parasites, potentially implying a transmission route for bTB. In addition, chronic parasitic infections can modulate immune response, potentially affecting the ability to respond to disease and interfere with diagnostic tests. However, the precise relationship between specific GI nematode species and bTB in cattle remains limited.

This interdisciplinary project will utilise advanced molecular analysis techniques to unravel the complex interactions between Mycobacterium bovis, the causative agent of Bovine TB, the farm environment and infective nematodes of cattle.

Through enhanced molecular analysis techniques, including real time PCR and deep amplicon sequencing methodologies previously developed and optimised by the project supervisors, the project aims to shed light on key infection risk areas for bTB on persistently infected farms and identify potential intervention points to break the transmission cycle. The project will also link up with the Pembrokeshire bTB project, a unique veterinarian and farmer led project funded by Welsh Government and in partnership with Aberystwyth University (AU), and the BBSRC funded endemic livestock disease project ‘Precision Solutions for fasciolosis control in sheep’ an AU project which will use eDNA analysis techniques to evaluate disease risk in livestock, collaborations that will enhance training and research opportunities for the successful candidate.

Training opportunities:

You will acquire inter-disciplinary skills in molecular biology, parasitology, microbiology, epidemiology and generic research methods and communication. Specifically, you will develop skills to perform a range of DNA extraction and amplification methodologies, to culture nematodes from cattle faeces and to conduct next generation sequencing methodologies. Training will be provided by the supervisory team and by Aberystwyth University's Graduate School Doctoral Training Programme.

You will also work closely and receive training and mentoring from staff of the Pembrokeshire Project, a unique veterinarian and farmer led project funded by Welsh Government and in partnership AU, and the BBSRC funded endemic livestock disease project 'Precision Solutions for fasciolosis control in sheep' a project which will use environmental DNA analysis techniques to evaluate disease risk in livestock. You will also have access to funds to support attendance of national and international conferences.

Student profile:

The project would suit a student with a keen interest in veterinary health, livestock production, parasitology and microbiology. Applicants will require an upper second-class BSc honours degree (or equivalent), in biology, microbiology, parasitology, agriculture, veterinary, animal science or a closely related subject. Experience and training in parasitology, microbiology and/or molecular biology is desirable but not essential as extensive training will be provided.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this is £18,622 and it 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.