Targeted Project / AY 2023 -2024

Development of an in vitro model of the ruminant intestine for studies of host-parasite-microbe interactions

Supervisor: Prof Cinzia Cantacessi (cc779@cam.ac.uk)

Department/Institute: Veterinary Medicine

Co-supervisor: Prof Róisín M. Owens (Chemical Engineering and Biotechnology)

Research area: Host-parasite-microbe interactions

Project outline:

Gastrointestinal (GI) helminths are amongst the most important infectious agents of livestock; demand for novel, sustainable strategies for parasite control is high. Evidence has emerged of the role of the gut microbiota in host-parasite crosstalk, which makes the development of microbiome-targeting anti-parasitics a plausible option. An improved understanding of the mechanisms underpinning this interplay is however needed. Typically, the analysis of such interactions relies on gut samples collected from live animals. However, this approach (i) often involves tens to hundreds of animals continually exposed to parasites for prolonged periods; (ii) data is highly variable because of a myriad of factors that shape the composition of the gut microbiota; (iii) calculations of effect size and, in turn, statistical power, are challenging. To address these issues, our laboratories have developed a prototype 3D in vitro model of the vertebrate gut-immune axis, as an alternative to both field studies and experimental infections of sheep models with GI worms. This proposal aims to optimise this system as an adaptable device to accommodate longitudinal, mechanistic studies of host-parasite-microbiota relationships, therefore reducing the reliance on in vivo models of worm infections and inconsistent faecal sampling.

The specific aims of this project will be to:

1) Optimise the design of the device to allow anaerobic co-cultures of gut microbiome;

2) Adapt the device to include gut epithelial and immune cells from key farmed animals;

3) Incorporate a complex animal microbiome into the device;

4) Employ the optimised 3D model in proof-of-concept studies of host-helminth-microbiome interactions.

BBSRC DTP main strategic theme: Bioscience for sustainable agriculture and food