Targeted Project / AY 2025 -2026

Innate antiviral immunity as a barrier to zoonotic virus infection

Project Reference: TRG-PAT-BF

Supervisor: Dr Brian Ferguson (bf234@cam.ac.uk)

Department/Institute: Pathology

Website: https://www.fergusonlab.path.cam.ac.uk/

Co-supervisor: Professor Clare Bryant (Veterinary Medicine)

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

BBSRC DTP secondary strategic theme: Understanding the rules of life

Project outline:

The transmission of viruses between species faces significant barriers due to differences in host immune systems. A virus adapted to an animal host might not be well-equipped to evade the human immune system. However, mutations and other viral adaptations can occasionally overcome these barriers, leading to zoonotic infections. This concept is exemplified by the ongoing avian influenza pandemic which is now spread from birds to mammals, including livestock cow herds. Understanding and strengthening antiviral immunity is therefore crucial in preventing and controlling zoonotic diseases and for improving human and livestock health by, for example, driving next-generation vaccine development.

The molecular and cellular mechanisms by which human cells sense and respond to infection are well characterised and known to be essential for host defence against viruses. Despite their importance as sources of food, their economic importance, and as sources of zoonotic pathogens, for the majority of livestock species these innate immune systems are relatively poorly defined.

In this project we the student will define the functions of PRRs that sense viral nucleic acids across multiple species, including sheep, cows, chickens, and ducks and compare them to humans. The project will employ loss of function assays, using CRISPR/Cas9, signalling and targeted perturb-seq experiments to understand the functions of these receptors. The project will also include a range of virus infection models, for example influenza viruses and poxviruses, to define how PRRs from these key livestock species impacts antiviral responses in the context of zoonotic infections.