PhD Studentship: Using machine learning to identify the molecular determinants of vector-borne transmission in viruses

Project Ref: 2024/07
Anticipated Start Date: October 2024 **Duration:** 3.5 years full-time
Closing date to apply: 02.04.24

Eligibility:

- This studentship is open to science graduates with, or who anticipate obtaining, at least a 2:1 or equivalent, in a relevant biological subject in their undergraduate degree, or a Masters degree - subject to university regulations**.** Other first degrees, e.g. veterinary science, will be considered. You should be looking for a challenging, interdisciplinary research training environment and have an active interest in the control of infectious diseases.
- This is a 3.5-year fully funded studentship open to UK nationals. International applicants are welcome to apply, however overseas university tuition fees are **not included** in the studentship funding – see funding information below.
- Students without English as a first language must provide evidence that they meet the English language requirement, e.g. with an average IELTS score of 7.0, with no lower than 7.0 in listening/reading and no lower than 6.5 in speaking/writing.

Supervision:

Principal Supervisors: Dr Kevin Maringer (The Pirbright Institute), Dr Joe Grove (MRC-University of Glasgow Centre for Virus Research)
Co-Supervisors: Dr Trevor Sweeney (The Pirbright Institute)

Research Groups: Flavivirus Transmission & Pathogenesis

Project Details:

One third of all emerging infectious diseases are vector-borne. Arthropod vectors facilitate virus host-switching and emergence by bridging vertebrate hosts that might otherwise not come in contact, and because they allow viruses to bypass host barriers to infection by injecting virus directly into the bloodstream. Many genetically diverse groups of viruses have independently adopted vector-borne transmission, and they are collectively known as the arboviruses (arthropod-borne viruses). The molecular factors required for facilitating a vector-borne dual-host lifecycle in evolutionarily divergent host species (vertebrate and invertebrate) evolved independently multiple times, sometimes within the same taxonomic group. The molecular adaptations that facilitate vector-borne transmission are almost completely uncharacterised, except for a few limited viral species-specific examples. Understanding how viruses evolve a dual-host vector-borne lifestyle is key to understanding arboviral transmission and emergence, and may allow us to develop transgenic vectors incapable of transmitting livestock and zoonotic diseases.

We are in a new era of machine-learning-enabled molecular virology. Using these methods, we can interrogate viral protein structure space in a very wide evolutionary context to identify overarching patterns of evolution - beyond the capabilities of traditional sequence comparisons that are more limited by evolutionary divergence. By combining machine learning with molecular virology, this project will characterise protein structures associated with vector-borne transmission in arboviruses. Depending on progress there may be opportunities to work in the Pirbright Institute's insectaries to verify findings *in vivo* in mosquitoes.

References for Background Reading:

Mifsud, J. *et al.* (2024) **Mapping glycoprotein structure reveals defining events in the evolution of the *Flaviviridae*.** *BioRxiv* https://doi.org/10.1101/2024.02.06.579159

Shah, P. *et al.* (2018) **Comparative Flavivirus-Host Protein Interaction Mapping Reveals Mechanisms of Dengue and Zika Virus Pathogenesis.** *Cell.* 175, 1931–1945 https://doi.org/10.1016/j.cell.2018.11.028

Ketkar, H. *et al.* (2019) **Genetic Determinants of the Re-Emergence of Arboviral Diseases.** *Viruses.* 11(2), 150 **https://doi.org/10.3390/v11020150**

Registration, Training and Funding:

This is a Pirbright Institute/University of Glasgow fully funded studentship. All students are eligible for the full award (stipend and **home rated** university tuition fees). **International students will attract tuition fees at the overseas rate and must therefore be able to fund the difference between home and overseas tuition fees themselves. For home student eligibility guidelines, please refer to the UKRI Full Eligibility Criteria (Annex B)**.

The student will be based primarily at The Pirbright Institute and registered with the University of Glasgow. The student will spend a defined period of time at the Centre for Virus Research, University of Glasgow and will visit the university to meet with their supervisors and undertake training or complete specific project tasks as required throughout the PhD. Eligible students will receive a UKRI-aligned stipend (minimum £18,622 for 2023/24) plus a cost of living top-up allowance of £2,200 per annum. Home rated university tuition fees will be paid. Highly subsidised Pirbright Institute student housing will be offered. A full range of research and transferrable skills training will be made available to the student as appropriate.

Applications:

How to Apply: closing date 02.04.24

Essential documents:

- Application Form
- CV
- Two references sent directly by your referees

Please email your application to studentship@pirbright.ac.uk by the closing date.