

PhD Studentship: New bioinformatics and statistical methods for the analysis and visualisation of FMDV sequences

Closing date: 12.04.19
Project Ref: 2019-10/PR/JP
Anticipated Start Date: October 2019
Duration: 3.5 years full-time

Eligibility:

- Due to the multidisciplinary nature of this project, applicants are required to hold an undergraduate degree in either **Bioinformatics, Biological Sciences, Computer Sciences, Statistics or related subject** with at least a 2:1 or equivalent. **Programming skills (coding) are essential.** Experience in molecular biology, bioinformatics and/or epidemiology is desirable.
- This is a **fully-funded studentship only open to UK students and eligible EU students who qualify for home-rated fees**, in line with BBSRC criteria: [Residential Guidelines for Research Council Studentships](#)
- Students without English as a first language must also provide evidence that they meet the English language requirement, e.g. with an IELTS score of 7.0 and no less than 6.5 in any of the subsections.

Supervision:

Principal Supervisors: [Dr Paolo Ribeca](#) (The Pirbright Institute), [Dr Joaquin Prada](#) (University of Surrey)
Co-Supervisor: [Dr Dan Horton](#) (University of Surrey), [Dr Yasaman Kalantar-Motamedi](#) (The Pirbright Institute)

Project Details:

This project presents a unique and truly exciting opportunity to work in an exemplary inter-disciplinary team to develop new analytical methods for viral research, while making them accessible to scientists with little computational background.

Foot-and-mouth disease (FMD) is a scourge of hooved livestock, with major economic impact particularly on low income countries in Asia and Africa. Informed decisions about controlling FMD outbreaks can only be made by exploiting the relation between the strain responsible for the outbreak and known viral strains. The FMD World Reference Laboratory at The Pirbright Institute (TPI) has sequenced an extensive catalogue of representative viruses, sampling infected animals and vaccine strains across a broad geographic and temporal range. However, given the complex population structure and molecular biology of FMDV, sophisticated data analysis methods are necessary to extract and provide reliable information on new viral strains.

The FMDV Toolkit portal was recently initiated by the Integrative Biology and Bioinformatics group at TPI. It aims to empower the FMDV research community around the world, and especially researchers in low income countries, by democratising access to such analysis methods, and making them available through a user-friendly web interface. The main goal of the proposed PhD project will be the development of novel statistical and visualisation techniques for FMDV Toolkit to provide useful and timely information to aid control of outbreaks in resource poor countries.

The student will have full flexibility into the direction of the project, as multiple sources of information will require integration of diverse statistical, computational and bioinformatic approaches. Some of the areas we expect the student to work on are as follows:

- Phylogenetic analyses and phylogeographic inference with multiple tools, both based on known software such as BEAST and newer approaches leading to a comparative analysis of how different phylodynamic and phylogeographic approaches work for FMDV. Reconstruction of mutational trajectories and their fitness/immunity properties will be based on a combination of standard phylogenetic tools (e.g. RAxML) and ad-hoc methods for FMDV based on recent work from the literature on different viruses.

- Biochemical and immunological properties of mutations to be inferred using machine learning approaches that are already being tested on serology data being available to the FMDV reference lab and other labs at TPI.
- For the integration of different sources of information, different general-purpose statistical approaches (PCA/CA/PLS, clustering and classification methods) could be applied alongside statistical machine learning techniques when possible. This could include explicit models, if they become available, and Bayesian techniques which will be used to build an extended phylogeographic and phylodynamic approach including a fitness landscape synthesis of the structural and immunological information.

The student will thus mainly focus on the back-end of the FMDV Toolkit portal, implementing some of the methods described above. However, the student will also have the opportunity to implement part of the front-end, for example to build a visual interface for the results of the computation.

References for Background Reading:

1. Ferretti et al. *Viruses* 10 (5), 221 (2018)
2. Marco-Sola et al. *Nature Methods* 9 (12), 1185-U76 (2012)
3. Horton et al. *PLoS NTD* 9 (3) (2015)
4. Ludi et al. *J. Gen Virol* 95, 384-392 (2014)

Registration, Training and Funding:

The project is co-funded by University of Surrey and will be carried out in collaboration with Dr Joaquin Prada, Lecturer in Veterinary Epidemiology, and Dr Dan Horton, Lecturer in Veterinary Virology. The student will be based at the Pirbright Institute and spend time at the University of Surrey's School of Veterinary Medicine during the project. The student will be registered with the University of Surrey. Due to the multidisciplinary nature of the project, applicants are required to hold an undergraduate degree in either Bioinformatics, Biological Sciences, Computer Sciences, Statistics or related subject. Programming skills (coding) are essential. Experience in molecular biology, bioinformatics and/or epidemiology is desirable.

Eligible students will receive a minimum annual stipend of £15,009 and university registration fees will be paid. A full range of research and transferrable skills training will be made available to the student as appropriate.

Applications:

Details of how to apply can be found here: [How to apply](#)

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 noted above.

Applicants are invited to contact Dr Ribeca at Pirbright, or Dr Prada at Surrey, to discuss the project informally prior to making an application.

