

Department of Veterinary Medicine

Available PhD Project:

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Project Title: Quantifying the risk of zoonotic spillover at the wildlife-human interface

Description: While many emerging infectious diseases in animals and people are of zoonotic origin, the true extent of zoonotic spillover (i.e. pathogen transmission across host species) remains poorly characterised. Even for well-known diseases causing recurrent outbreaks (e.g. Ebola, avian influenza, Nipah or coronaviruses), the routes of transmission and the frequency of exposure are very hard to assess, often requiring painstaking forensic investigations or extensive surveillance programmes.

In recent years, there has been growing research effort into mapping and predicting zoonotic disease outbreaks, often across large geographic areas, based on similarity with past outbreaks and known distributions of host species. Although these are useful to highlight surveillance needs and compare relative risks across space, they often lack the level of mechanistic detail required to quantify absolute risk and make specific predictions. In parallel, a general theory of zoonotic spillover has been developed, highlighting the importance of ecological dynamics and stochastic processes.

The aim of this project will be to characterise and quantify zoonotic spillover processes across multiple pathogens and multiple regions. The first objective will be to collate evidence from the literature into a database, with an initial focus on viruses with mammalian reservoirs. The second objective will be the development of a mathematical modelling framework for zoonotic spillover that can be adapted to different pathogens, and the characterisation of the properties of the model through numerical simulations. Lastly, the model will be used in depth to quantify spillover risks across space and time for a selected subset of pathogens.

This project will be inter-disciplinary with ample opportunities to learn new skills, particularly in scientific programming and data analysis. Prospective applicants may have degrees in biology, medical or veterinary sciences or in applied mathematics, and should have some experience of programming in R, Python or Matlab.

Suggested reading:

- Plowright, R.K., Parrish, C.R., McCallum, H., Hudson, P.J., Ko, A.I., Graham, A.L., Lloyd-Smith, J.O., 2017. Pathways to zoonotic spillover. *Nature Reviews Microbiology* 15, 502–510.

<https://doi.org/10.1038/nrmicro.2017.45>

- Becker, D.J., Washburne, A.D., Faust, C.L., Mordecai, E.A., Plowright, R.K., 2019. The problem of scale in the prediction and management of pathogen spillover. *Phil. Trans. R. Soc. B* 374, 20190224.

<https://doi.org/10.1098/rstb.2019.0224>

For further information about the project, please contact Olivier Restif: or226@cam.ac.uk

Funding: This project is not funded - applicants are invited to apply before the Cambridge University Postgraduate Funding competition deadline in order to be nominated for suitable scholarships.

How to apply: Contact the Supervisor to discuss the project before submitting an official application. More details on the application process here:

[How to apply — Department of Veterinary Medicine \(cam.ac.uk\)](#)