The impact of population structure on the evolution of virus virulence

Supervisors:
Professor Mike Boots, CLES, University of Exeter
Dr Lena Wilfert, CLES, University of Exeter
Hosting institution: University of Exeter

Project description: Understanding the processes that underpin and maintain virulence (i.e. parasite-induced host mortality) is critical to disease management. Classic virulence evolution theory suggests that parasites evolve virulence as a consequence of their maximization of lifetime transmission. Most of this theory assumes that populations are completely mixed with all individuals interacting equally, and that all hosts are equally susceptible. Neither of these assumptions is realistic. Recent theory – developed in large part by the lead supervisor - has shown that the spatial characteristics of parasite transmission can have dramatic impacts on virulence evolution, with local interactions selecting for lower virulence (reviewed in Lion and Boots 2010). This important prediction has empirical support in laboratory systems (Boots and Mealor 2007), but the question remains whether it is relevant to real-world disease interactions.
Boots has recently been awarded a BBSRC-NIH EEID grant with collaborators at Emory and the University of Georgia that will carry out a large-scale experiment that manipulates the spatial structure of honey populations. The aim of the proposal is to examine how different management practices impact the evolution of virulence of the varroa mite. We propose to take advantage of this experiment to ask how the spatial manipulation impacts on the viral pathogens of the honey bees. The student will examine how changes in the population structure imacts on the viral community and the diversity/virulence of the natural viruses in the system

Boots, M. & M. Mealor (2007). Local interactions select for lower infectivity. Science 315, 1184-1186.
Lion S, Boots M (2010) Are parasites ''prudent'' in space? Ecology Letters 13: 1245-1255.

Training opportunities: The student will gain skills and be trained in (1) invertebrate pathology, (2) virology, (3) sequencing, (4) bio-informatics, (6) theoretical modelling. In particular they will work with Lena Wilfert on experimental virus infections, gaining skills in ecological virology and with Boots on developing evolutionary ecological model