Andy White
Mathematics, Heriot Watt University, Edinburgh, EH14 4AS.
e-mail: `A.R.White@hw.ac.uk`
Alex Best
University of Sheffield
Eva Kisdi
University of Helsinki
Janis Antonovics
University of Virginia
Mike Brockhurst
University of Liverpool
Mike Boots
University of Sheffield

The evolution of host-parasite range

Understanding the coevolution of hosts and parasites is one of the key challenges for evolutionary biology. Adaptive dynamics techniques have examined coevolutionary outcomes in classical infectious disease model frameworks in which infection depends on absolute rates of transmission and defence [1]. These models typically predict either that one strain dominates or that there is evolutionary branching, where disruptive selection around a fitness minimum causes the emergence of two distinct strains. This may therefore provide insight into the onset of diversity but does not fully explain the generation and maintenance of the wide range of variation in host and parasite strains observed in natural systems. Here we present a fully co-evolutionary host-parasite model using the assumptions of adaptive dynamics, but rather than assuming that transmissibility and defence are absolute we approximate an 'all or nothing' infection process where the success of infection depends upon the relative 'range' of host resistance and parasite infectivity. A parasite that can infect a wide range of host strains will pay a cost in terms of disease transmission compared to parasites that infect a narrower range of hosts. A similar trade-off exists in terms of the range of parasite strains a host can resist and the host reproductive rate. Infection success therefore depends on the specific characteristics of both the parasite and the host. We show that considerable diversity can be generated and maintained due to epidemiological feedbacks, with strains differing in the range of host and parasite types they can respectively infect or resist [2]. The patterns of resistance and infectivity are also in close agreement with laboratory results that assess the evolutionary behaviour in a bacteria-phage system.

References

[1] Best, A., White, A. and Boots, M. 2009. *The implications of coevolutionary dynamics to host-parasite interactions.* American Naturalist, **173**: 779-791.

[2] Best, A., White, A., Kisdi, E., Antonovics, J., Brockhurst, M. A. and Boots, M. 2010. *The evolution of host-parasite range.* American Naturalist, **176**: 63-71.