

The use and underuse of model systems in infectious disease ecology & evolution.

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Abstract

Ever since biologists began studying the ecology and evolution of infectious diseases (EEID), laboratory-based ‘model systems’ have been important for developing and testing theory. Yet what EEID researchers mean by ‘model systems’ and what they want from them remains to be clearly delineated. This uncertainty holds back our ability to maximally exploit these systems, identify knowledge gaps, and establish effective new model systems. Here, we borrow a definition of model systems from the biomolecular sciences to assess how EEID researchers are (and are not) using ten key model systems. According to this definition, model systems in EEID are not being used to their fullest and, in fact, cannot even be considered to be model systems. Research using these systems consistently addresses only two of the three fundamental processes that underlie disease dynamics—transmission and disease, but not recovery. Further, studies tend to focus on only a few of the scales of biological organization that matter for disease ecology and evolution. Moreover, the field lacks an infrastructure to perform comparative analyses. We aim to begin a discussion of what we want from model systems, which would further progress toward a thorough, holistic understanding of EEID.

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