

Modelling epidemics

Valerie ISHAM

University College London, Department of Statistical Science London, UK

Abstract

Epidemics of human and animal diseases often cause mortality and morbidity on a massive scale, and have the potential for severe economic and social disruption. Understanding the dynamics of the spread of an infectious disease brings possibilities for its control and mathematical modelling has an important role to play in this. Such modelling has a long and distinguished history and is one of the most successful areas of mathematical biology. In these lectures, I will describe some very simple models appropriate for the spread of microparasites (e.g. viruses or bacteria) in a homogeneous host population, and discuss properties such as the necessary conditions for invasion and persistence of the infection. I will then describe how these models and their properties generalise to allow for more realistic scenarios in which there may be many different sorts of population heterogeneity and structure. Finally, I will consider some of the more complex models that are appropriate for macroparasite (e.g. helminth) infections, and how these models can be used to answer questions about the mechanisms involved in disease transmission.