

## PREFACE

The impact of infectious diseases on human and animal is enormous, both in terms of physical and mental sufferings, and social and economic consequences, which were demonstrated by the SARS outbreaks that have occurred in many countries in 2003. Mathematical modeling is an essential tool in studying a diverse range of such diseases. Basic aims in studying their spread, both in time and in space, are to gain a better understanding of transmission mechanisms and those features that are most influential in that spread, so as to enable predictions to be made, and to determine and evaluate control strategies. In the latter area, mathematical models have a particularly important role to play in making public health decisions on the control of infectious diseases.

In 2005, a three-month Program entitled *Mathematical Modeling of Infectious Diseases: Dynamics and Control* was organized by the Institute for Mathematical Sciences of the National University of Singapore. The program consisted of five different sessions, namely (i) New development of the SEIR models; (ii) Influenza-like diseases; (iii) Immunity, vaccination, and other control strategies; (iv) Molecular analysis of infectious diseases; and (v) Clinical and public health applications of mathematical modeling. It was a great honor of having Professor Bryan Grenfell from Pennsylvania State University to chair the organizing committee (of which both of us co-chaired). These tutorial notes were based on the lecture materials delivered by three speakers for some of the sessions.

This tutorial is designed to introduce clinicians working on infectious disease, epidemiologists, mathematicians and statisticians to the diverse models that describe the spread dynamics of infectious diseases. Although written by three professors, the chapters are, however, very well-interlinked in such a way that they provide a unified approach from mathematical concepts to applications.

The first three chapters by Professor Herbert Hethcote from University of Iowa provide fundamental concepts and mathematical backgrounds

on formulating mathematical models for various infectious diseases. These chapters set the scene and basis for subsequent chapters.

The fourth chapter by Professor Ping Yan from the Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada addresses some statistical and probability issues in modeling of infections. Some interesting real examples are studied based on the statistical and probability analysis.

The last chapter is by Professor John Glasser from Centers for Disease Control and Prevention (CDC) of USA. Professor Glasser is an experienced applied and mathematical modeler, and tries to avoid using any difficult mathematical formulae in this chapter. Instead, as a government officer, he illustrates mathematical modeling via various examples from his practical experience.

Last but not least, we would like to thank everyone from the Institute for Mathematical Sciences, other members of the organization committee, as well as the speakers and participants from the Program. Without their support and presence, the publication of this tutorial will never come true.

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