

Preface

Dynamical systems theory in mathematical biology and environmental science has attracted much attention from many scientific fields as well as mathematics. For example, "chaos" is one of its typical topics. Recently the preservation of endangered species has become one of the most important issues in biology and environmental science, because of the recent rapid loss of biodiversity in the world. In this respect, permanence and persistence, the new concepts in dynamical systems theory, are important. These give a new aspect in mathematics that includes various nonlinear phenomena such as chaos and phase transition, as well as the traditional concepts of stability and oscillation. Permanence and persistence analyses are expected not only to develop as new fields in mathematics but also to provide useful measures of robust survival for biological species in conservation biology and ecosystem management. Thus the study of dynamical systems will hopefully lead us to a useful policy for bio-diversity problems and the conservation of endangered species. This brings us to recognize the importance of collaborations among mathematicians, biologists, environmental scientists and many related scientists as well. Mathematicians should establish a mathematical basis describing the various problems that appear in the dynamical systems of biology, and feed back their work to biology and environmental sciences. Biologists and environmental scientists should clarify/build the model systems that are important in their own as global biological and environmental problems. In the end mathematics, biology and environmental sciences develop together.

The International Symposium "Dynamical Systems Theory and Its Applications to Biology and Environmental Sciences", held at Hamamatsu, Japan, March 14th-17th, 2004, under the chairmanship of one of the editors (Y.T.), gave the editors the idea for the book *Mathematics for Life Science and Medicine* and the chapters include material presented at the symposium as invited lectures.

The editors asked authors of each chapter to follow some guidelines:

1. to keep in mind that each chapter will be read by many non-experts, who do not have background knowledges of the field;
2. at the beginning of each chapter, to explain the biological background of the modeling and theoretical work. This need not include detailed information about the biology, but enough knowledge to understand the model in question;
3. to review and summarize the previous theoretical and mathematical works and explain the context in which their own work is placed;
4. to explain the meaning of each term in the mathematical models, and the reason why the particular functional form is chosen, what is different from other authors' choices etc. What is obvious for the author may not be obvious for general readers;
5. then to present the mathematical analysis, which can be the main part of each chapter. If it is too technical, only the results and the main points of the technique of the mathematical analysis should be presented, rather than showing all the steps of mathematical proof;
6. at the end of each chapter, to have a section ("Discussion") in which the author discusses biological implications of the outcome of the mathematical analysis (in addition to mathematical discussion).

Mathematics for Life Science and Medicine includes a wide variety of stimulating fields, such as epidemiology, and gives an overview of the theoretical study of infectious disease dynamics and evolution. We hope that the book will be useful as a source of future research projects on various aspects of infectious disease dynamics. It is also hoped that the book will be useful to graduate students in the mathematical and biological sciences, as well as to those in some areas of engineering and medicine. Readers should have had a course in calculus, and knowledge of basic differential equations would be helpful.

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