## Preface

The present volume contains original research articles of a wide spectrum of research topics in mathematical and theoretical biology which were presented at the 2nd Symposium on "Theory of Biomathematics and Its Application," which was held at Research Institute for Mathematical Sciences, Kyoto University, November 21st–25th, 2005.

Finite and infinite dimensional dynamical systems theory in mathematical biology has been attracted much attention from many scientific fields as well as mathematics. For an example, phenomenon of "chaos" is well known as one of the typical topics. Recently the preservation of endangered species becomes one of the most important issues in biology, because of the recent rapid loss of biodiversity in the world. In this relation, permanence or persistence, the new concepts in dynamical systems theory, seems important. These concepts give a new aspect in mathematics and mathematical sciences that includes various nonlinear phenomena as well as the traditional concepts of stability and oscillation. Mathematicians should establish a mathematical basis on the various problems appeared in 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 the global biological and environmental problems of their own. In the end, mathematics, biology and environmental sciences develop together.

The purpose of the 2nd RIMS Symposium on "Theory of Biomathematics and Its Application" was to discuss many interests on the rich properties of dynamical systems appeared in biology.

As editors of this volume, we have chosen 8 papers which discuss a wide variety of stimulating fields as population biology, immunology and other field in biology.

Kawasaki and Shigesada present an integro-difference model for biological invasions under a periodically fragmented environment and discuss how the habitat fragmentation influences the invasion speed.

Namba discusses an ordinary differential system to explain dispersal-mediated coexistence of locally exclusive competitors and shows that dispersal can save inferior competitors from local extinction. Kon proposes a general nonlinear structured population model governed by ordinary differential equations. He shows that the instability of the population free (extinct) equilibrium point ensures the survival of all structured populations. Liu and Takeuchi consider a general periodic single-species system with periodic impulsive perturbations and give sufficient condition for permanence of the system. They show that the species never go extinct if the average per capita increasing rate in one natural cycle, incorporating with the impulsive perturbations and the intrinsic growth of the species is greater than 1 for sufficiently small quantity of the species. Sato constructs the population dynamics as stochastic processes in continuous time for each family name and examines the effect of the finite size of population on the distribution of family names. The other three papers treat other interesting problems in biology and medicine. Hosono treats a reaction-diffusion system of autocatalytic reaction processes and studies the existence of traveling fronts and their propagation speeds. Shoji numerically discusses three dimensional structures of Turing's patterns in reaction-diffusion systems of activator-inhibitor type. Sasaki and Kajiwara studies a type of ordinary differential equations called B cell models to consider some problems of autoimmunity by using dynamical system theories.

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