FROM THE GUEST EDITORS

The editors of this special issue of Mathematical Biosciences and Engineering were the main organizers for the First International Workshop "Mathematical Methods in System Biology," that took place on January 4-7, 2010 at Tel Aviv University in Tel Aviv, Israel. The workshop, initially planned as a small meeting, was an overwhelming success with 170 participants from Israel, the US, Canada and Europe. It included about 100 presentations: invited talks, special sessions dedicated to application of mathematical tools to various areas in biology and poster sessions which gave graduate students and young scientists a stage to present their research. We managed to attract a good mix of mathematicians working on biological and medical applications with biologists and medical doctors interested to present their challenging problems and to find mathematical tools for their solution. We would like to take the opportunity to thank the Office of International Science and Engineering of the National Science Foundation and the Society for Mathematical Biology for their support in bringing US participants to this event. Thanks are also due to the Vice-President for Research and Development of Tel Aviv University, the Faculty of Exact Sciences and its Dean Prof. Haim Wolfson, and the School of Mathematical Sciences for their help with covering local expenses. Special thanks are coming to the supporting team of students, postdocs and administrative staff for their incredible contribution to the success of the workshop.

Following the kind invitation of Prof. Yang Kuang, who was also a member of the Organizing Committee, we decided to put together this volume as a special issue of the journal Mathematical Biosciences and Engineering. This volume is not intended as a comprehensive proceedings of the workshop – only the authors with original research results were invited to contribute and only journal quality articles were accepted. All manuscripts underwent a rigorous reviewing process. It was hard, but also rewarding work and the joint efforts of the authors and referees led to significant improvements and enrichment of the papers. As in any peer-reviewed journal, some submissions were found not suitable for the volume.

The twenty five articles contained in this special issue represent a large spectrum of topics. They illustrate applications of methods and tools from various fields of mathematics to systems biology. A large group of papers address modeling of cancer growth and various treatment strategies. They range from papers describing general cancer related phenomena, like cancer cell migration through tissue (J. Kelkel, C. Surulescu) or tumor cell behavior under environmental influence (A. Friedman, Y. Kim) to papers modeling novel cancer treatments like anti-angiogenesis (U. Ledzewicz, H. Schaettler and U. Forys et al.) or the pharmacokinetics of the anti-cancer drug paclitaxel (R.E. Marsh et al). Models of cyclic treatment of CML (leukemia) (N. Komarova) or BCG treatment of bladder cancer (S. Bunimovich and Y. Goltzer) take us deeper into specific types of cancer and their corresponding treatments. The paper by U. Forys and J. Poleszczuk makes a

connection between cancer and the action of the immune system under HIV, which in more detail, with the emphasis on the role of X4 virus is discussed by A. Weinberger and A. Perelson. A different type of paper is presented by C. Wiseman who, under an intriguing title, shares with us his reflections on immunotherapy given through the eyes of an experienced clinician-oncologist. The number of papers address general cell behavior scenarios. In particular, they include modeling of cell dispersion (C. Surulescu and N. Surulescu), theory of multicellular spheroids (A. Fasano et al) and analysis of dynamical processes during the mammalian cell cycle (O. Lavi et al).

Cancer and related issues are by no means the only topic of our volume. There are interesting papers on epidemiology by J. Franke and A. Yakubu describing a general class of SIS models and by O. Barnea et. al describing a model for seasonal influenza in Israel. A very important and rarely addressed topic is covered by H. Gaff in her paper on modeling tick-borne disease based on her field studies. A research group from Portugal led by A. Sequeira brings to this volume interesting studies of cerebral aneurysm and blood coagulation dynamics. They also allowed us to use a snapshot from one of their eye-catching simulations for the cover page of this issue (A.M. Gambaruto et al.). Multiscale computational modeling of blood cell formation is the topic of the paper by the group from the Moffitt Cancer Research Center led by R. Gatenby. An inspiring plenary talk by A. Friedman became the basis of the paper by A. Friedman and C. Xue on mathematical modeling of chronic wounds. All these results were obtained with the use of various mathematical methods and techniques that originated from the fields of mathematical analysis, dynamical systems, optimal control, numerical analysis and many others. For example, the control theory technique of sliding modes found its application to the regulation of glucose levels (L. Dorel). Mathematical physics, in particular, kinetic theory was employed to model bacteria-phagocytes dynamics (R. Malka and V. Rom-Kedar) and adaptive responses in biological systems (T. Friedlander and N. Brenner) whereas some functional analysis methods applied to biological system were presented by P. Hinow and F. Farkasz.

The variety of biological challenges and the wealth of mathematical tools addressing them makes this volume an important contribution in biomathematics. We believe that this volume will find its place on the bookshelves of mathematicians active or interested to join the growing field of mathematical biology and of biologists looking for novel theoretical and computational approaches to advance their research.

We would like to thank all the authors for their valuable contributions and to the referees for their tremendous work on reviewing the manuscripts. Special thanks to Yang Kuang for making this publication possible.

Guest Editors:

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