PREFACE

Cancer has become one of the main causes of mortality in industrialized societies. Developing methods of improving the existing therapies is therefore an urgent task. Scientific studies directed towards improvements in tumor therapies become increasingly interdisciplinary. In this process, mathematical modelling, qualitative analysis and computer simulation begin to play an essential role: "*As in physics, understanding the complex, non-linear systems in cancer biology will require ongoing interdisciplinary, interactive research in which mathematical models, informed by extant data and continuously revised by new information, guide experimental design and interpretation*" (R.A. Gatenby and Ph.K. Maini, *Cancer summed up*, Nature, 421, 2003). "*Certainly, one cannot hope that mathematics can directly solve problems in immunology. However, it can contribute to a research program in modelling and simulating particular aspects and behaviors of the immune system*" (N. Bellomo and E. De Angelis, *Strategies of applied mathematics towards an immuno-mathematical theory of tumors and immune theory interactions*, Math. Models Methods Appl. Sci., 8, 1998).

The workshop on *Cancer Growth and Progression, Mathematical Problems and Computer Simulations*, held in Będlewo (Poland), on 17–21 June 2002, was dedicated to selected methods of the mathematical modelling of cancer evolution, the competition of cancer cells with the immune system, the qualitative analysis and optimization of models and computer simulations. The main aim was to apply these methods to gain a deeper insight into the evolution of cancer and possible progress in its therapy.

The present special issue includes selected papers presented during the workshop. They concern different mathematical methods used to describe the development of cancer and the competition between the immune system and the cancer. Various mathematical settings were used, including finite-dimensional and infinite-dimensional dynamical systems as well as deterministic and stochastic processes. Systems of ordinary differential equations, systems of reaction-diffusion equations, equations with time delay, and kinetic equations of the Boltzmann type, describing the statistical behavior of the cancer cells interacting with immune system cells, were proposed and analyzed. The modelling of cancer growth and progression dynamics was carried out at the cellular and macroscopic levels. A major focus was on the competition between the cancer and the immune system as well as genetic conditioning in the context of improving cancer therapy. The mathematical analysis was supplemented by computer simulation. Another major focus of the workshop was the study of interactions between genes and cells, using the tools of computational biology, and of their use in cancer research. This includes papers devoted to the processing of microarray data as well as papers dealing with haplotype and SNP analysis or models for DNA statistics.

Part of the papers in the special issue stem from the European research and training programme *Improving the Human Research Potential and the Socio-Economic Knowledge Base* carried out within the Research Training Network (RTN) entitled *Using Mathematical and Computer Simulations to Improve Cancer Therapy*. In addition, the Będlewo workshop itself was organized in the framework of the above-mentioned RTN. Young researchers involved in the RTN contributed some of the papers. The authors acknowledge the financial support of the European Commission through the Human Potential Programme. Some Polish participants of the workshop were supported by the State Committee for Scientific Research (KBN) in Poland through SPUB-M grants or PBZ grants. Some other participants were also supported by the NATO Collaborative Linkage Grant LST CLG 977845, other grants of the State Committee for Scientific Research in Poland as well as NSF and NIH grants.

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