FOREWORD

This volume contains lectures given at the Tenth Symposium on Some Mathematical Questions in Biology, held in Boston on February 24, 1976 in conjunction with the annual meeting of the American Association for the Advancement of Science. The Symposium was cosponsored by the American Mathematical Society and by the Society for Industrial and Applied Mathematics under the auspices of Section A, Mathematics, of the AAAS.

Three main themes are reflected in the lectures contained in this volume. The first two papers, by George Bell and Byron Goldstein, present a coordinated development of mathematical models in immunology. The mathematical foundations of this subject have been laid primarily within the past decade; and Bell, Goldstein, and their associates have played a major role. Their contributions provide a stimulating introduction to this vital new area of mathematical investigation.

Bell begins with a discussion of the biological fundamentals of the immune system, the kinetics of aggregation, and the theory of clonal selection by which the immune system learns to deal with unfamiliar antigens. He then discusses his own patching model, designed to explain critical phenomena in the activation of the cells which can secrete antibodies, and the mechanisms by which an individual avoids making antibodies to its own antigens. Goldstein follows with a survey of assay methods for circulating antibodies and for antibody-producing cells. He goes on to discuss two approaches for studying organism response to antigen injection, the clonal selection model of Bell and the optimality approach of Perelson, Mirmirani, and Oster. The complementarity of these two approaches parallels similar developments in evolutionary theory.

In the two middle papers in the volume, Hans Othmer and Stuart Kauffman

address questions of significance for developmental biology. Kauffman's paper is reprinted with minor change from D. L. Solomon and C. F. Walter (eds.), Mathematical Models in Biological Discovery, Lecture Notes in Biomathematics, Volume 13, Springer-Verlag, Heidelberg. Othmer, utilizing the basic diffusion-reaction approach which has been shown to be of universal interest throughout theoretical biology, surveys a variety of mechanisms which lead to spatial pattern formation. Such questions arose a quarter-century ago in Turing's discussion of morphogenesis, and continue to have major implications for developmental biology. Kauffman examines the control of the periodic nature of the cell cycle, investigating and contrasting a variety of models and relating his investigations to other work on biological clocks. In particular he presents his own limit cycle model, and assesses the current status of that model in the light of experimental investigations.

The final two papers, by Sol Rubinow and Garrett Odell, address problems in biomechanics, which have a rich history but have not been well represented in this series. Rubinow discusses several fluid mechanical problems with particular emphasis on blood flow in arteries and veins and on the swimming of microorganisms. Odell develops a new continuum theory of axoplasmic transport with special reference to the movement of nerve cell cytoplasm within the confines of the axon membrane.

It is a pleasure, as in years past, to once again acknowledge the support of the National Science Foundation and the staff of the American Mathematical Society.

SIMON A. LEVIN