Preface

The origins of cell and molecular biology are rooted firmly in studies on fertilization. Those familiar with the classic monograph of E. B. Wilson (1928), "The Cell in Development and Heredity," will recognize that almost all of the central and still challenging problems in cell and molecular biology were investigated first in a developmental system, often an invertebrate gamete or embryo. Experimental manipulation of eggs from lower vertebrates, especially amphibians, expanded the conclusions derived from these fertilization studies. Moreover, the recent advances in routinely reliable methods for *in vitro* fertilization and embryo culture of mammalian oocytes, including those from humans, coupled with the power of molecular probes are resulting in conclusions with important and often surprising implications for cell and molecular biology.

While the fields of cell and molecular biology have profited from fertilization as a model system for detailed investigations, understanding of the fertilization process has advanced correspondingly owing to this scrutiny as well as to the relative ease of designing experimental approaches. Indeed, the availability of sophisticated methods and probes is generating considerable new knowledge about the mechanisms accounting for gamete formation, recognition and fusion, reinitiation of the egg's metabolism, blocks to polyspermy, and cytoskeletal and motility events, as well as the changes in the pronuclei which permit syngamy and the activation of new gene expression.

The goal of "The Molecular Biology of Fertilization" and its companion volume "The Cell Biology of Fertilization" is to bring together reviews from leading laboratories in which various aspects of the fertilization process are studied. An assortment of experimental approaches is presented, using methods of cell biology, molecular biology, biochemistry, biophysics, enzymology, and immunology. Though our goal was to solicit articles on exciting research areas, a diversity of animal models is considered. Representatives from five invertebrate phyla are presented, including nematodes, clams, insects, ascidians, and the classic sea urchin. Amphibians and mammals are the best understood vertebrates, and it is encouraging that a diversity of mammals is now being explored. The articles consider the familiar mouse, rat, and hamster

models, and also inquire about the fertilization process in farm animals, including pigs, sheep, and the Wisconsin favorite, the cow, as well as the animal with consequential clinical and ethical considerations, humans.

The chapters cover various aspects of fertilization as studied from different points of view by various authors. These articles summarize work at varying levels of organization. In many cases we asked the contributors to restrict themselves to studies of one particular problem or with a specific approach. The authors were asked to include an overview of the field, to review recent and active research in their own laboratories, and to describe the conclusions in a manner which would be readily understood by a broad range of biologists, including those just beginning studies of fertilization as well as those in allied areas. They were encouraged to speculate on the future directions of fertilization research and to contribute new and unpublished material. We anticipate that these volumes will provide background and perspectives into research on fertilization that will be of use to a broad range of scientists, including advanced students interested in fundamental cell and molecular processes, cell biologists, molecular biologists, developmental biologists, geneticists, biochemists, biophysicists, and reproductive biologists.

Each book is subdivided into three sections. "The Molecular Biology of Fertilization" begins with a series of chapters on the molecules involved in sperm–egg recognition and binding. Part II explores pronuclear formation, activation, and the cytoskeletal events resulting in syngamy and cell cycle progression. Part III covers oncogenes, gene expression, and nuclear determination at fertilization and during embryogenesis. Its companion volume "The Cell Biology of Fertilization" first considers sperm behavior and motility. Part II reviews aspects of egg architecture, ranging from extracellular remodeling, through cortical and cytoskeletal structure, to the organization of the nuclei which participate in fertilization and embryogenesis. Part III evaluates the regulatory ions involved in egg activation as well as the manner in which the sperm initiates this cascade of events. It is our hope that these books will provide the reader with a deeper appreciation of the present state of knowledge and the future directions for cellular and molecular investigations on fertilization, which is the critical event bridging our discontinuity in generations.

We are indebted to the Cell Biology series editors, Drs. Dennis Buetow, Ivan Cameron, George Padilla, and Arthur Zimmerman for cheerfully answering a myriad of questions and providing helpful advice. We are grateful for the thoughtful and timely contributions by the authors. Finally, we would like to extend a word of thanks to their funding agencies around the world, without whose support basic biomedical research would be seriously endangered. We thank Ms. Gina Hellenbrand for superb and tireless assistance.

Heide Schatten
Gerald Schatten