This book presents a diverse collection of chapters on basic research at the molecular level using the Lepidoptera as model systems. This volume, however, is more than just a compendium of information about insect systems in general or the Lepidoptera in particular. Each chapter is a self-contained treatment of a broad subject area, providing sufficient background to give readers a sense of the guiding principles and central questions associated with each topic, in addition to major methodologies and findings. Comparisons with other major model systems are emphasized, with special attention given to the fruit fly, *Drosophila melanogaster*. Topics include a historical overview of research using lepidopteran models, silkworm genetics, mobile elements of lepidopteran genomes, lepidopteran phylogeny, experimental embryogenesis and homeotic genes, chorion gene regulation and evolution, regulation of silk protein and homeobox genes in the silk gland, control of transcription by RNA polymerase III, hormonal regulation of gene expression during development, hormone action in the central nervous system, the molecular genetics of moth olfaction, the immune response, and use of engineered baculoviruses for basic biological studies and insect pest control.

MOLECULAR MODEL SYSTEMS IN THE LEPIDOPTERA

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Dedicated to Carroll M. Williams, whose contributions and inspiration played such a large part in the development of lepidopteran model systems

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Preface

The Lepidoptera present something of a puzzle in biological science. Although represented by the only insect to be fully domesticated – the silkworm, *Bombyx mori* – and providing experimental subjects for much ground-breaking work in physiology and genetics, their virtues as model systems for molecular studies are still comparatively little recognized. This seems particularly striking when one notes the attention lavished in recent years on one diminutive distant cousin of the butterflies and moths, namely, the fruit fly, *Drosophila melanogaster*. Yet the Lepidoptera continue to have much to offer, both in their own right as experimental subjects and in a wide range of comparative studies. Our deliberate intention in organizing the present volume was to help focus attention on this diverse, fascinating, and immensely useful group of organisms and, if possible, to increase their relative appreciation.

The germ for the idea of this book grew out of the first workshop on Molecular Genetics and Molecular Biology of the Lepidoptera, held at the Orthodox Academy in Kolymbari, Crete, in September 1988. This meeting – an outgrowth of several earlier silkworm meetings held in France and the United States – was organized by Fotis Kafatos and Marian Goldsmith in response to the needs of a growing community of lepidopteran researchers. For this group, there seemed to be no forum to share data, compare notes, and exchange ideas in the company of people familiar with the advantages and idiosyncrasies of their own experimental organisms. As impressed by the diversity of systems being studied at the molecular level in these insects and by the high quality of the work presented at Kolymbari as were the other participants, we conceived of this book while still buzzing with excitement from the meeting. Rather than publishing a series of potentially short-lived reports on the actual presentations we had

just heard, we and the prospective authors agreed that there was the greater need for a collection of broad overviews of selected subject areas, which would convey the nature and excitement of current work on the molecular biology of the Lepidoptera. To give the book a coherent framework, we took evolution, development, and regulation as unifying themes.

The sixteen chapters that follow will, we hope, achieve these aims. Each is intended to present a contemporary picture of its subject, both for workers in these different areas and for other biologists who would like to know more about the use of Lepidoptera as molecular model systems. Accordingly, each chapter has been written as a self-contained treatment of its subject, and we have tried to provide enough background to give readers a sense of the guiding principles and central questions associated with each of the fields represented, in addition to major methodologies and findings. Furthermore, acknowledging the importance of work in *Drosophila melanogaster* in biology today, the authors have also consciously framed the articles presented here in relation to what is known about the fruit fly, which often presents either an informative evolutionary parallel or a contrast to what has been found in lepidopteran systems. Finally, we unashamedly have tried to bring out the reasons for using lepidopteran models, including both their experimental advantages and their historical importance in the development of many lines of research.

Although the gestation period for this volume was lengthy, the delay was, in some respects, useful. While many of the topics covered in this volume originated with the first Lepidoptera workshop, others were added after the second workshop, held in 1991 under the leadership of Karen Sprague and Gerard Chavancy. In our intention to highlight certain well-developed or emerging lines of work, others were unavoidably omitted. We sincerely apologize for our omissions, and hope that, at the least, we have provided enough signposts to enable interested readers to fill in these gaps on their own.

We would like to extend our thanks to our authors, who met our deadlines and delivered their manuscripts to us on schedule, and to our editor, Robin Smith, for his patience and strong support of this project throughout. Whatever omissions there may be in the coverage presented here, we believe that the chapters in this book will provide a useful view of the state and breadth of lepidopteran molecular biology in the mid-1990s and that the reader will come away with not only a better idea of the fascinating biology of the Lepidoptera but a feeling for the directions that research in lepidopteran systems is likely to take in the second half of this decade.