Lepidopteran Surprises

Molecular Model Systems in the Lepidoptera. MARIAN K. GOLDSMITH and ADAM S. WILKINS, Eds. Cambridge University Press, New York, 1995. xii, 542 pp., illus. $125 or £65.

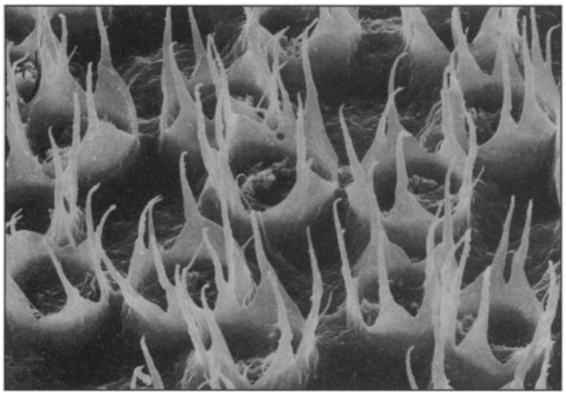
The great strides now being made in the molecular biology of fruit flies have tended to eclipse the contributions that some of their four-winged relatives have made to our understanding of biological phenomena. This book succeeds extremely well in highlighting the research carried out with moths and butterflies and reminding the reader that these colorful creatures are really the unsung heroes of many contemporary lines of research.

Besides being intrigued by the striking wing patterns of the Lepidoptera, scientists have found other compelling reasons to study moths and butterflies. The large size of certain lepidopteran species has facilitated surgical and biochemical studies. The economic importance of other species has prompted investigations that have often led to findings of fundamental significance to biology as well as practical significance to humans. The contributors to this book have obviously fallen for these charms of the Lepidoptera. They convey their enthusiasm for these insects in discussing contributions of lepidopteran systems to the history of biology as well as the promise that these systems hold for the future of biology.

Although each chapter is self-contained, the authors have consciously attempted to mesh their chapters. Rather than presenting specialized research reports, each chapter provides a broad overview of an important area in lepidopteran research. The discussions also freely consider other insects as well as vertebrates. The authors have not been hesitant to emphasize the advantages of lepidopteran systems, but they are keenly aware of their present limitations. A common refrain throughout the book is the need for a germline transformation system. Recombinant baculoviruses discussed in the book's last chapter promise to meet this challenge. Reductionist approaches pervade each chapter, but a holistic view emerges from the book's organization. The introductory chapter and the epilogue contribute greatly to this unity.

Many branches of contemporary invertebrate as well as vertebrate research have their roots in lepidopteran studies that have been largely forgotten. The opening chapter resurrects this history and is rich in surprises. Few readers will be aware that the first reported studies of mutations in animals were based on work with silk moths or that the earliest studies of homeotic mutants were undertaken with silk moths years before E. B. Lewis began his thorough studies of the *Drosophila* bithorax complex. As another example of lepidopteran legacies, the authors mention that a moth hormone was first used to demonstrate that genes can be the primary target of hormone action. Our present knowledge of insect endocrinology, immunology, and olfaction has developed almost entirely from work with Lepidoptera. Acknowledging these and other little-known contributions of lepidopteran research to the development of many research fields is also to acknowledge the often tortuous and unpredictable course of discovery in science.

If the history of lepidopteran research is filled with surprises, contemporary research with Lepidoptera is also yielding some. Similarities often exist between genes of moths and flies, but differences between genes of these two groups seem to be equally numerous. The homeodomains of homeobox genes in fruit flies and moths are highly conserved, yet the phenotypes of their mutant genes can be strikingly different. Both the sequences of chorion (eggshell) proteins in flies and their organization are very different from those in moths. Nevertheless, promoters of moth chorion genes can still be properly regulated in transgenic flies. Clearly, there's more than one way to make an insect.



"Scanning electron micrograph of aeropyle crowns on the surface of the eggshell from *Antheraea polyphemus*. (Scale marker = 10 μm.)" [From Regier *et al.*'s paper in *Molecular Model Systems in the Lepidoptera*]

As the editors and the contributors have made abundantly clear, "an understanding of complex biological phenomena will occur only when diverse systems are studied." Throughout the book we can see how various research areas have benefited from the interplay of different systems. Not only have the Lepidoptera been instrumental in initiating many of these lines of research, they promise to maintain this tradition.

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A Cellular Structure

The Telomere. DAVID KIPLING. Oxford University Press, New York, 1995. x, 208 pp., illus. $69.95 or £145; paper, $31.50 or £22.50.

At the outset, David Kipling assigns his subject a rather slippery definition: "a telomere is whatever biological structure makes the end of a natural chromosome behave differently from a double-stranded break." This definition launches an encompassing description of a fascinating field. It demands the juxtaposition of a host of poorly understood biological observations about telomeres and the current rapidly expanding molecular view. And the definition is historically precise: after all, telomeres were first defined as cytologically identifiable structures that prevented natural chromosomal termini from undergoing the breakage–fusion–bridge cycles exhibited by newly produced DNA breaks. From this perspective, questions flow freely from the body of existing data. Which of the known molecular properties of telomeres is most important for this defining behavior? For all the excitement over the discovery of terminal DNA sequence properties in many organisms and associated proteins in a few, this central question awaits a response.

The book, like the structure, incorporates biochemical, genetic, cell biological, organismal, and evolutionary aspects. In organization the treatment flows roughly along the lines of structural description, followed by a shift in emphasis toward functional observations and, once the stage is set, discussions of a provocative miscellany of topics. Alongside the description of tandem repeat sequences found at chromosomal termini in a large number of organisms is consideration of the evidence that these repeats are the necessary and sufficient DNA elements required for telomere function. For example, newly formed chromosomal breaks that behave like telomeres are found to have acquired telomeric tandem repeat DNA sequences at the new termini. Yet it is not clear what molecular features of chromosomal ends provide the defining telomeric behavior. The guanine-rich strands of repeat sequences from many organisms can associate to form guanine tetrad structures in vitro, which in the-