

## **Molecular Biology and Genetics of the Lepidoptera (Contemporary Topics in Entomology Series)**

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GOLDSMITH, M. R., AND MAREC, F. (EDS.). 2010. *Molecular Biology and Genetics of the Lepidoptera* (Contemporary Topics in Entomology Series). CRC Press, Boca Raton. xv + 362 pp. ISBN 978-1-4200-6014, hardback, \$129.95.

With more than 150,000 described species, butterflies and moths constitute one of the most diverse orders of insects. The number of actual species of Lepidoptera may be much greater, possibly as high as 500,000. Lepidoptera are thought to have radiated contemporaneously with flowering plants, and they are prominent in the literature on co-evolution. Caterpillars, both as external and internal feeders, are important components of terrestrial ecosystems worldwide, and many are pests to agriculture while also serving as pollinators. As perhaps one of the most conspicuous taxa of terrestrial invertebrates, Lepidoptera are also of central utility in ecosystem assessment and in educating the public in environmental conservation. Lepidoptera include numerous model organisms that have played central roles in biology, for studies on physiology, development, evolution, and genetics.

*Molecular Biology and Genetics of the Lepidoptera*, edited by Goldsmith & Marec, is a book of eighteen chapters that highlights recent developments on the genetics of Lepidoptera model systems. The book is in many ways a follow up to Goldsmith & Wilkins' (1995). With the advancement of molecular tools and methods, this timely work serves as an updated compilation, highlighting lepidopteran model systems that have become prominent in recent years.

The book begins with an overview of lepidopteran relationships, written by thirteen authors (Chapter 1). The chapter is divided into several sections, each representing a separate superfamily, outlining the role of model organisms in these superfamilies (Bombycoidea, Hesperoidea + Papilionoidea, Noctuoidea, Pyraloidea, and Tortricoidea). Each of these "superfamily sections" includes phylogenies compiled from various studies, and the trees are useful for identifying the phylogenetic position of models in each superfamily. The chapter also includes a "backbone" phylogeny of the Lepidoptera based on Kristensen & Skalski's (1998) tree from the *Handbook of Zoology*. Readers should be aware that two key studies on the molecular phylogeny of Lepidoptera have appeared very recently in the literature, namely Regier et al. (2009) and Mutanen et al. (2010) that are updates to Kristensen's tree. Researchers interested in understanding the phylogenetic position of model organisms should refer to these publications for an updated "backbone" phylogeny of the Lepidoptera.

Subsequent chapters focus on particular model species or genera, such as *Bombyx* (Chapter 2), *Heliconius* (Chapter 6), and *Helicoverpa* (Chapter 12). There are also chapters

on sex chromosome systems and genetics underlying sexual dimorphism (Chapters 3, 4), development of butterfly wing patterns and the genetics underlying them (Chapters 5, 6), molecular innovations of butterfly eyes (Chapter 7), and pheromone production and perception (Chapter 10). Many of these chapters contain fascinating facts, and information that is highly specialized. Of interest to me were the chapters on lepidopteran circadian clocks (Chapter 8) and the genetics that influence host ranges in Lepidoptera (Chapter 11). The former chapter includes numerous diagrams illustrating the mechanisms of circadian rhythms. This chapter also includes a section on how the circadian clock plays a role in the migration of monarch butterflies, which I found to be especially compelling. The latter chapter on host range (Chapter 11) reviews model taxa (*Euphydryas*, *Helicoverpa*, *Heliothis*, *Papilio*) in which the genetics underlying host specificity has been examined. As someone interested in host-use evolution in Lepidoptera, I found this chapter to be an especially informative source.

Latter chapters focus on another dominant theme, insect control. For instance, there are chapters on the genetics underlying insecticide resistance (Chapter 13), innate insect immune response (Chapter 14), interhemocoelic toxins for pest management (Chapter 16), and polydnaviruses in lepidopteran parasitoids (Chapter 17). These chapters are written in great detail to explain various aspects of insect/pest control, which also contain quite a bit of specialized terminology, and acronyms such as "PBLEs", "pro-PAP-3", and "V421M mutation" might overwhelm the average Lepidoptera enthusiast.

In conclusion, Goldsmith & Marec do an excellent job compiling a book written by a broad range of leading researchers studying various aspects of lepidopteran genetics. The compilation is not a coffee-table book, and the average reader may find it a bit hard to follow without a background in molecular biology. However, the book is an excellent summary of the recent progress in the field, and will be an invaluable resource for researchers and driven enthusiasts that are interested in learning more about the genetics of Lepidoptera.

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