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1

Introduction

Honey bee biology does not need much selling to attract the nontechnical reader, or the applied scientist working in agriculture. But are honey bees as interesting and important for basic scientists? The answer is yes. The honey bee is in fact one of the best-understood organisms from an integrative biology perspective. A search of any scientific search engine, for example, will locate thousands of papers about honey bee biology. The majority of these are not about agriculture, or any aspect of applied bee biology, but rather focus on the basic science of bees. Studies of their systems of communication, the developmental mechanisms leading to queen versus worker morphology, and division of labor, for example, have vast bodies of work.

This fascination with bees might need some explaining. Of course, model systems in biology, like the fruit fly, are the subject of many more studies than are honey bees. However, the fruit fly is a model for genetics, and the overwhelming majority of fruit fly studies are about that subject. There is considerable work on other aspects of fruit fly biology, but in general many aspects of their biology are understudied. In a sense, this is because these animals serve as medical models that we use to address biological questions of practical concern. This is generally the case for model systems.

In contrast to the model systems, the honey bee, until recently, was studied by biologists mainly because it is interesting and because we like bees. In other words, science simply for the sake of knowledge drives quite a lot of honey bee biology. Because of this, we know a great deal about every aspect of bee biology, both at the molecular and the organismal levels. This is not to say that the honey bee is not a model, as well, for some questions. The honey bee is in fact something of a model system for social insect biology. Social insects are the most complex animal societies, and they are ecologically dominant in many habitats. Among the social insects, the honey bees are not the most complex,

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but they are the most amenable to study. The long history of beekeeping, which provides many tools for the scientist, ensures that they are easier to work with than insects with no history of management. Hence, researchers interested in social behavior, pollination, communication, and many other topics naturally gravitate to the honey bee as a subject organism.

Having covered in broad strokes why the honey bee attracts so much attention, we now turn to the other major question of the introduction. Why this book and why now? The answer is simple. There is a wonderful reference for the basic biology of the honey bee, Mark Winston's *The Biology of the Honey Bee*. This has long been on the shelves of scientists interested in bees. Beekeepers interested in acquiring a deeper understanding of the creatures they love have also made much use of this work. However, Winston's book is now over 30 years old and is out of date on many subjects. It is chiefly lacking in two ways. First, many of the subjects covered in the Winston book have changed radically in scope, with major new approaches having uncovered phenomena unknown when that book was published. Second, there are now several fields in biology that, although present 30 years ago, were little studied, and hence did not get covered in Winston's book. Some of these fields are now larger than some traditional fields; examples include toxicology, pollination, and immunity. Hence, the goal of this book is to provide a new standard reference for honey bee biology that explores this fascinating insect from both traditional and new scientific perspectives.

To the Beekeeper

This is a book for scientists about the biology of honey bees, so one might be surprised to find a section addressed to beekeepers. The surprised person would not be too familiar with beekeepers, however, since this group of enthusiasts is so fascinated by the colonies they care for that they routinely buy books such as this and invite practicing scientists to talk at their beekeeping clubs. I personally have seen the Winston book in the hands of many beekeepers. Hence, I want to provide a brief guide to reading this book for the nonscientist.

In general, any topic that does not take a molecular approach should be approachable for a beekeeper. This includes most of the work on anatomy and physiology, taxonomy, reproduction, neuroethology, division of labor, task allocation, chemical communication, nesting biology, parasites and pathogens, tropical bees, and pollination. These are the topics typically of most in-

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terest to beekeepers. Although there is some molecular biology in these sections, it is not central to understanding the science. The chapters on development, evolution, genetics, and neurobiology, in contrast, are probably too technical for the lay reader. However, I think with some determination the beekeeper could grasp the key ideas even in these chapters. I say this because there are now so many free sources of information to get a better understanding of background material. I imagine with some background reading, and maybe viewing of some science tutorials on YouTube, that quite of lot of the technical material might become transparent.

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