

## ❧ PREFACE ❧

I am not a honey bee researcher. One might then wonder why a person with formal training in aquatic ecology rather than honey bees would take a turn at writing a book about the honey bee. The stretch isn't as far as it might at first seem.

My PhD research involved studies of insect feeding, though the insects I worked with were aquatic rather than terrestrial. In addition, similar to the streams and rivers where I have done research as well as the insects (and other organisms) that live in them, honey bees are *integrators* of what takes place on the land. They incorporate, are impacted by, and act according to conditions and events not only inside the beehive but also in the environment that surrounds it. Honey bees show us clearly the interconnectedness of the natural world—and our activities in it. Yet, perhaps most relevant here, I am one of many who have kept and learned about bees, one of many who have simply fallen in love with the honey bee.

I first became intrigued by the honey bee when, during an introductory course in Biology, a professor spoke of research on their dance language. I no longer have my notes from the class, but suspect that he may have been reading Karl von Frisch's *The Dance Language and Orientation of Bees*, which was published in 1967.

It was during this period as well that I learned about research defining the double helix we now casually refer to as *DNA*. One particular class session, which took place in a large lecture-style room at the University of Louisville, was especially memorable. I do not remember the words that were spoken—only that, when I heard them, I felt one of those profound moments of connection with all of life. What was in me—the DNA—was in the person sitting across the aisle from me; it had continued unbroken along myriad lines, including those of giraffes and dinosaurs and the jonquils that lined the side of the house where we lived on Claremont Avenue. The realization took my breath away.

None of this is “news” today given that we have mapped the honey bee genome as well as our own, yet it was news to me then and the sense of connection remains. What also remains is a deep respect for the intelligence that pervades life as we know it, intelligence such as that exhibited by the honey bee. It is perhaps not without reason that people say, “The more we know, the more we know we don’t know.” The bee dance that first piqued my curiosity continues to be elucidated—and debated—to this day.

**E**ven though my love affair with the honey bee began in my teens, it was long before I ever kept bees. And I kept bees long before I learned many of the details of honey bee biology. This kind of thing happens all of the time, for we daily manage natural systems, large and small, for better and for worse, without knowing or understanding much about the magnificent organisms involved, much less about the intricate environments of which they are part—even though we ourselves live with other organisms and are part of these same environments.

Although this book has grown out of early experiences, it was coaxed into existence during the period in which I kept bees. The work presented here is an attempt to answer some of the questions that occupied my mind as I worked honey bee colonies, primarily questions about the superb interplay of form and function exhibited by this highly organized insect. Because of my focus on beekeeping, my questions revolved largely around the worker and her activities—though the queen and drone clearly play roles here, too. In essence, my curiosity might be summed up in one question:

*How does the honey bee worker do what she does?*

Although much remains to be learned, and much may never be fully understood, a portion of the worker’s story is told here with words based primarily on the work of researchers who have studied the honey bee for many decades and who have generally presented their findings to relatively technical audiences.

I have written with the intention of making technical information more accessible to insect enthusiasts of all ages, especially those who are interested in the honey bee. Those interested in insects generally may find basic information that secures their foundation in entomology—“insectology,” as a young person I spoke with recently called it. Learning about one insect supports and enriches our learning about others.

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I have written also for those who may not be particularly “taken with” insects, yet are “hooked on” the plants and the ecological systems that support the honey bee colony. Gardeners and growers may be curious about bees and the work they do in pollinating the plants they care for and love. In addition, naturalists and others interested in ecological relationships may gain footing here, for, even though the honey bee may be studied as an individual insect (whether it be the worker, the queen, or the drone) *apart* from the colony and the beehive, it is the colony *as a whole* that is a functioning organism interacting with the environment surrounding the beehive.

The need for additional understanding, particularly by those who keep bees today, has grown along with the complexities involved in managing honey bee colonies. Those who work bees now have to pay attention to an ever-increasing number of “other” organisms, including pests and diseases as nonnative as the honey bee, organisms that vie for space both inside the beehive and inside the bee. We ourselves are among these “other” organisms as we have, among other things, facilitated the introduction and spread of pests and diseases, moved honey bees across the country and back again, sprayed herbicides and pesticides in managing agricultural crops, and made changes throughout the land that have reduced both the amount and the diversity of habitat and resources available for honey bees and numerous other pollinators.

Although I have worked to “simplify without oversimplifying” the material presented here, I understand that I have retained much detail in elucidating the honey bee’s story. For some readers, it may be a level of detail that is a bit daunting. The information included speaks to the enormous potential and plasticity the honey bee worker exhibits in altering her behavior and physiology in the face of changes in the colony and the environment. The more we learn about any natural system, the more we find complexity and beauty and cause for wonder. The more we attend to something, the more we see—and the more we learn to see differently. My hope is that the embedded details, the facts and the numbers, provide a textured foundation for the worker’s story. For further study, I include a listing of the works I have used in developing the material along with a glossary and index for reference.

The honey bee is a well-studied insect. I encourage the reader to review the citations listed and check out more of the specifics provided in the ingenious research aimed at understanding this marvelous organism. At the same time, please keep in mind that I have at times found discrepancies and “gaps” in the information I have reviewed. Often enough, I have neither been able to find answers easily nor have I been able to find them all together in one place.

Answers to some of my seemingly simple questions have been elusive at best. On occasion, researchers have made assumptions about what is “true” because no other explanation seemed plausible at the time, and these assumptions then have been carried along in interpretations of later research. We continue to work with and make such assumptions today; it is part of doing science as we act to understand and make sense of the world around us.

Finding definitive answers also has been difficult no doubt because of differences among the various subspecies of *Apis mellifera* involved in the studies reported; variations in genetics yield differences in not only appearance but also physiology and behavior. In addition, the environment in which a given study is conducted may impact findings as it affects the worker and her colony. Further, just as we differ from one another in our ways, the same is true of individual honey bees. They are not little bee “automatons.” Variations are part of the reason that researchers do replications in experiments and repeat studies. My efforts to resolve discrepancies and to find clear answers during my explorations have been both frustrating and funny at times. All too often it seems, the answer to my question *Is it this?* or *Is it that?* is only—*Yes*.

**M**any changes have taken place during the interval of time over which I have put this material together. Among these changes are concerns about the spread of not only American foulbrood but also European foulbrood. *Nosema apis*, a parasite of the honey bee long classified as a protozoan, has been reclassified as a fungus. *Nosema ceranae*, originally found in the Asian honey bee *Apis cerana*, has jumped species to the European honey bee *Apis mellifera*, the subject of this book, and is predominant in colonies now. The small hive beetle *Aethina tumida*, native to Africa, now also treads American soil. Further, we are experiencing increased colony losses as a result of what is being called *Colony Collapse Disorder*. Gone are the days when skunks, bears, and American foulbrood were the primary concern of beekeepers, though these, too, continue to wreak their own versions of havoc on honey bee colonies.

At the same time, awareness of the honey bee and the vital role that this insect plays in our culture has grown. We have honey bees in the National Zoo and honey bees that fly from their hive across the lawn of the White House. People in towns and cities that have banned beekeeping within their limits are rewriting regulations in genuine support of beekeeping as they gain better understanding of the practice—and the need. Increasing numbers of people of all ages are “dancing

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with bees” as they take up beekeeping and learn to work colonies of their own. Further, additional locations are being used to host colonies—sites that range from airport to rooftop to zoo. Other pollinators, including bumble bees and Mason bees, are gaining deserved attention, too.

I have updated information as I have found it to ensure that the material presented is as representative of current thinking as I can make it. Yet, this work is not comprehensive and my research has not been exhaustive. All of us who have kept bees have bee stories. And many of us have spent nights awake in search of a solution to a perceived problem only to find the next morning that the bees figured things out on their own; they managed the situation in their own way—often as not, a way that was not among the options we had considered. This kind of thing is a source of the long-standing joke: *The bees didn't read the book*. I invite the reader to keep an open mind throughout.

Our knowledge and understanding of the honey bee continue to change, at times rapidly. Those engaged in specific areas of research are the primary sources of relevant information. This book cannot help but remain a work in progress. I welcome comments, corrections, explanations, and elaborations as well as additional questions. Through the research, review, and writing, I have learned that even those who work closely with the honey bee are at times surprised at what they may yet learn about this fascinating insect.

My own appreciation and respect for the honey bee and the honey bee colony—and the intelligence they exhibit—continue to grow. The time spent in getting to know this organism has further opened doors of wonder, which alone has made the effort worthwhile. Even so, my hope is that this is also true for those who read these pages. We have much to learn about the world of which we ourselves are a part, and I believe the honey bee has much to teach us still.