Preface

In the preface to the second edition of Evolutionary Biology (1986), I remarked that during the seven-year interval since its predecessor, the field of evolutionary biology had become even more exuberant, more commanding of the full sweep of biology, than ever. Eleven years later, the same may be said with even greater force. Subjects such as evolutionary developmental biology and evolutionary physiology are growing with new vigor, topics such as the evolution of genetic systems are being plumbed more deeply, and evolutionary biologists are increasingly aware of the contributions they can make to applied fields such as health science, human genetics, agriculture, and conservation. New conceptual approaches have come to the fore in population genetics, phylogenetic methods are now applied to a great range of questions in a new integration of evolutionary history with evolutionary processes, and molecular methods have revolutionized almost every subdiscipline of evolutionary science. Outside of evolutionary biology as such, within such fields as molecular and developmental biology, it is increasingly recognized that the methods, concepts, and perspective of evolutionary biology can provide illumination—that "nothing in biology makes sense except in the light of evolution" (Dobzhansky 1973).

Every teacher knows how hard it is to frame a course for a diverse class of students who differ in background and motivation. The writer of a textbook faces a similar difficulty. The predecessors of this book have been used in advanced undergraduate and beginning graduate courses, and have found use by graduate students and by biologists in other fields as an entry into the evolutionary literature. I have tried again to serve these audiences, and again have emphasized that evolutionary biology, like every other science, is not a static collection of facts and verities, but instead is a dynamic enterprise in which new questions arise, old questions remain only partially answered, and almost all conclusions are incomplete and at least somewhat tentative. It is as important, then, to emphasize not only the accomplishments of a science, but also its procedures—how hypotheses are framed and tested, how evidence is interpreted, how the history of a question engenders the questions we ask today.

The previous editions of this book have been criticized for slighting some important topics, and for too densely written a presentation to serve the needs of some students. I have tried to correct these faults by adding chapters (17–21) on topics that were omitted or treated only briefly in previous editions, and by more expansive, even relaxed expositions that I hope will make the subject more accessible, especially for undergraduates. Hence, I have provided simpler but often longer explanations, especially of basic principles; have presented extended examples of observations and experiments that should serve not only to incarnate concepts but also to provide detailed evidence and to illustrate the methods of evolutionary science; and have indulged in redundancy where it seemed necessary. The cost of these changes has been a book that, at least in size, is something of a hopeful monster. Still, the product, though perhaps excessive, is no longer than some textbooks of biochemistry, molecular biology, and genetics, which, however broad in scope, are narrower than a field that embraces and illuminates all the life sciences.

Probably few instructors will assign the whole book for a one-semester course. They may feel that the core of the subject resides in Chapters 1, 2, 5-7, 9-13, 14 in part, 15, 16, and 23-25. Chapters 3 and 4 may provide needed background for some students, and many instructors will select additional material from Chapters 8, 17-21, and 26. Chapter 22, on molecular evolution, treats one of the most dynamic topics in contemporary evolutionary biology, but molecular methods and some aspects of molecular evolution are also integrated into many other chapters.

In the 1986 edition, I acceded to the practice of many instructors by beginning (after the prefatory background chapters) with genetic mechanisms of evolutionary change and proceeding to phylogeny, macroevolution, and evolutionary history. I have become convinced that, at least for undergraduate courses, the sequence adopted in

the 1979 edition is more effective, and I have returned to it. Thus, the exposition in this edition begins with phylogeny and patterns of historical evolution (Part II), turns then to evolutionary processes (Part III), and after treating character evolution (Part IV), returns to macroevolution considered in the light of the theory of processes (Part V). I have readopted this sequence for both pedagogical and intellectual reasons. Many students want to learn about evolution because of curiosity about biological diversity, or dinosaurs, or how humans fit into the grand history of life. Their interest is better captured or held by beginning with the history of life and how we can come to know it than with the abstract concepts and reductions of population genetics—an acquired taste that most students must be taught to appreciate. Phylogeny, diversity, and evolutionary history, moreover, are the foundation and raison d'être of evolutionary biology. These are the subjects that provide evidence for evolution, and that have provided both fundamentally important concepts (e.g., homology, cladogenesis) and the phenomena that evolutionary theory is designed to explain. Evolutionary biology, finally, is an inescapably historical subject—even population genetics is largely devoted to inferring the historical events responsible for the genetic composition of populations—and it is well to emphasize the historical perspective from the outset. Almost every subject in evolutionary biology is informed by history, phylogeny, and "tree thinking," from gene trees to patterns of species diversity.

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