

Preface

When I started work on this book, my vision was a grand synthesis of coevolutionary theory. As I worked on the first few chapters, however, I began to see that what I was writing was far too technical to be useful to more than a handful of individuals. What I realized then was that the book I really wanted to write was one that made coevolutionary theory accessible to the broadest possible audience. At that point, the goal became writing a book that students, post docs, and faculty could turn to when they needed to understand the basic foundations of coevolutionary theory or wanted to develop a model of their own. The result is a book that focuses on developing and analyzing the simplest possible models that answer specific coevolutionary questions. To this end, each chapter begins by posing a specific coevolutionary question and then works to answer this question by developing and analyzing a mathematical model. I have tried to make the mathematical models more concrete by grounding them in the biology of well-studied coevolutionary systems. In so doing, I hope to provide some insight regarding what are often the most challenging parts of mathematical modeling: translating a biological question into equations and mathematical analyses, and then translating the results back into biologically meaningful answers. One consequence of the approach I have taken is that the book does not provide a comprehensive review of coevolutionary theory.

An ancillary goal of this book is to move coevolutionary theory from its current place as a quirky sideshow and into its rightful place as a fundamental generalization of population and quantitative genetics. From a purely mathematical standpoint, this argument is irrefutable: Both population and quantitative genetics are special cases of a more general theory that includes evolutionary feedbacks

between interacting species. One reason evolutionary theory has not yet been generalized to include coevolution is that coevolution presents unique mathematical challenges, requiring at least twice the number of variables and equations as an equivalent single-species model. It should come as little surprise, then, that we have worked out the simpler case of single-species evolution before moving on to develop a more general theory that includes coevolution. By providing an accessible introduction to coevolutionary theory, I hope this book will help cultivate a new generation of evolutionary theorists who are comfortable with coevolution and have the skills to generalize existing single-species models.

Finally, although I have done my best to make the theory in this book self-contained, it proved impossible to develop all of the basic mathematical tools and evolutionary results from scratch yet still finish the book in a single lifetime. As a consequence, readers with a limited (or rusty) mathematical or evolutionary background may find it useful to have two books on hand: *Theory of Population Genetics and Evolutionary Ecology: An Introduction* by Joan Roughgarden and *A Biologist's Guide to Mathematical Modeling in Ecology and Evolution* by Sally Otto and Troy Day.

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