

Preface

We now know that species are always evolving. Natural selection constantly adjusts the traits of populations generation after generation. In this book I explore what we have learned about why evolution is so relentless. Amid the flood of exquisite new results, I wanted to step back and ask what we now know, and still need to know, about the processes that drive adaptive evolution and shape the entangled web of life. I especially wanted to consider, from multiple perspectives, what we have learned from some of the best-studied examples of adaptive evolution in species and their interactions with each other. My hope is that these chapters show we have made great progress in recent years in our understanding of why evolution is unrelenting.

The book begins with what we know about the pace of adaptation and the intensity of natural selection (part 1) and the genetics of adaptation and coadaptation (part 2). Using those first two sections as background, I then explore the ecological forces that drive ongoing adaptation (parts 3 and 4) and diversification (part 5). The book ends with two synthetic chapters (part 6).

While I was writing this book, I sometimes felt as if I were racing against evolution itself in synthesizing the results of recent studies. Nothing captured that feeling more than an exchange I had one day with Peter and Rosemary Grant. I had written to them to ask if I could use in this book a modified version of a graph they had published a few years earlier. The graph showed evolution of beak size in one of Darwin's finches over more than thirty years. They wrote back to say that using the graph was fine with them, but had I seen their recently published updated graph showing evidence, from the past several years, that the birds had undergone another evolutionary shift?

This book continues an arc of argument about evolution of the web of life that I have been probing over the past four decades, with parts of the work summarized in three earlier books. In *Interaction and Coevolution* (Thompson 1982), I considered how natural selection acts on different forms of interaction among species—parasitism, predation, grazing, competition, and various forms of mutualism. In *The Coevolutionary Process* (Thompson 1994), I suggested how specialization, the local adaptation of populations, and environmentally varying selection on interacting species continually reshapes coevolution among species. I also discussed how the rift between

ecology and evolutionary biology held back for decades our general understanding of the evolutionary process. Then, in *The Geographic Mosaic of Coevolution* (Thompson 2005), I broadened the discussion and considered how geographic variation in species shapes their interactions and the co-evolutionary process. This book extends the discussion by considering how selection imposed by physical and biotic environments together drive continuing evolution in populations.

With so much research on evolution and coevolution being published each year, it is impossible to synthesize the entire history of past work. Therefore, this book draws primarily on research published since 2005, when *The Geographic Mosaic of Coevolution* was published. Even so, these chapters capture only some of the great breadth and depth of new research on adaptive evolutionary change.

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