along with valuable tips (e.g., beware of poor grammar and typos in letters), contribute to this short chapter’s being one of the most practical. In contrast, “STEM in the real world” is excessively long and seems less relevant for most 18- to 22-year-old STEM students. For example, this chapter contains a significant amount of information about engaging in entrepreneurial activities as an undergraduate—an activity few STEM students are going to have time for.

Although the “STEM in the real world” chapter could benefit from some heavy pruning, most of the other chapters are succinct, relevant, and offer practical advice and insightful examples. If all STEM students were to read this book during their freshman year and follow one-quarter of the advice, they would certainly excel as undergraduates. Although it is more likely that the motivated and high-performing students will be the ones who actually read it, if they gain even a couple of new ideas that help them to persevere in STEM, then the book will be a success.

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GROUP SELECTION AT THE UNIVERSITY OF CHICAGO:
A SCIENTIFIC MEMOIR TO CHALLENGE CONSENSUS

Adaptation in Metapopulations: How Interaction Changes Evolution.

Since my high-school biology classes (in the early 2000s), I learned that natural selection acted at the level of the individual, not on groups of individuals and definitely not on entire species. As a graduate student of evolutionary biology, this sentiment eased only slightly, and most authorities would typically claim something along the lines of “group selection can occur, but it is not as strong as individual selection and unlikely to explain adaptations in nature.” Given seminal readings on the topic, including Richard Dawkins’s celebrated The Selfish Gene and George C. Williams’s Adaptation and Natural Selection, I myself could be heard arguing along those lines on the rare occasion that there was somebody to argue against. But I must admit that I never really convinced myself on the matter, so Michael Wade’s Adaptation in Metapopulations, which argues for the power and prevalence of group selection, was a welcome counterpoint to the general consensus.

In Adaptation in Metapopulations, Wade narrates his career-long investigations into group (or multilevel) natural selection. The slightly puzzling subtitle, How Interaction Changes Evolution, is quickly understood to be the general conclusion of decades of committed research by Wade and his collaborators: When genes, individuals, and the environment interact with one another, group selection can be a powerful and persistent force of evolution in subdivided populations—even more powerful than selection at the individual level.

Wade, now a distinguished professor of biology at the University of Indiana Bloomington, walks the reader through over 30 years of research efforts at the University of Chicago, beginning with his PhD thesis (around 1975). The focus is on laboratory studies of group selection with the red flour beetle (Tribolium castaneum), with additional exposition of his field program on willow leaf beetles (Plagiodera versicolara) and the development of new theory in evolutionary genetics. And Wade takes advantage of the opportunity to mix in vignettes of his personal and professional life, giving the book a distinct flavor of memoir.

Readers should expect an accessible exposure to group selection, but the book is not a comprehensive review of the subject. The details of theoretical and empirical work by other researchers in the field are usually given just enough treatment to serve as foils for the work and ideas of Wade, his colleagues, and a few other influential thinkers—most notably Sewall Wright. Readers who become interested in deeply grasping the controversy and science around group selection—a likely outcome of reading this book—will want to continue their efforts with further reading. I expect at least a few will even be inspired to design new experiments in their own systems or open a fresh session of their favorite programming language to experience Wade’s assertions firsthand.

I found the book hugely valuable for two reasons. First, Wade offers the reader a remarkably clear view of science as carried out by real people in the real world. He offers detailed thought processes behind each research effort, bringing to life the dynamic interplay among ingenuity, perseverance, opportunity, and constraint that leads scientific progress down unpredictable paths. In this way, the reader gets a strong impression of how iterative feedbacks between theory and empiricism lead to novel insights.

Accordingly, the book will be especially useful for early-career researchers because it presents an admirable model for how to structure
a productive academic career in scientific research with humility. In addition, the book will be accessible to any readers with a strong understanding of introductory evolutionary biology but may be most useful to those with at least some exposure to more advanced population- and quantitative-genetics theory. Graduate students in evolutionary biology will find this book a refreshing break from intensive study of advanced texts, reinforcing technical knowledge while exposing them to an important and historical controversy.

Second, Wade’s research program during this period of his career is marked by some of the most important advances in the historical and ongoing debate about levels of selection. Wade presents a brief overview of the debate surrounding group selection before detailing the approaches and results of over a dozen experiments for the remainder of the book, addressing the concerns of standard theory one by one. Of the many interesting findings presented in this book, perhaps the most important takeaway for me is the recognition that nonadditive sources of genetic variation can contribute to the evolutionary response to selection at the group level. This is one of many reasons why genetic variation among groups could be greater than variation within groups and cause group selection to be more powerful than individual selection.

Although the iterative explanation of complex experiments is at times fatiguing (and perhaps wanting of a few more figures), Wade never fails to maintain intrigue by clearly positioning the experiments in a historical context of vigorous debate. The reader comes away with a strong understanding of differences between the perspectives of modern-synthesis giants Ronald A. Fisher and Sewall Wright and later influential thinkers on this topic, including Vero Wynne-Edwards, George C. Williams, John Maynard-Smith, and Richard Dawkins.

In particular, I found the chapter on the evolution of sociality especially useful, because this is where a bulk of the popular debate around group selection appears to be focused. Wade deftly demonstrates how kin selection and multilevel selection have come to be seen as largely equivalent but how a multilevel selection perspective offers superior predictive power on account of greater attention to mechanism. We also learn how the inevitable invasion of cooperative groups by cheaters is a fallacy and begin to question the intuitive gene’s-eye view of evolution famously espoused by Richard Dawkins in the The Selfish Gene.

Of the most valuable aspects of the book is the detailed attention to Sewall Wright’s estranged shifting-balance theory, which proposes that group selection by differential dispersal leads to the regional acquisition of high-fitness gene combinations. It is here that the reader comes to understand how Wright and Fisher differed in the degree to which they believed populations to be subdivided and how Fisher’s perspective has become more deeply entrenched in evolutionary theory. We are left with an impression that cultural norms within our science have led to a dismissive attitude toward multilevel selection. In this light, Wade’s commitment to testing unpopular ideas is seen to be particularly bold and his success particularly admirable.

Adaptation in Metapopulations offers a welcome challenge to the hard assertions of my schooling that selection acts only at the level of the individual, and it presents a convincing case that group selection cannot be dismissed so quickly. Wade has clearly done his part to move the needle of public opinion on this historical and divisive topic in evolutionary biology and here offers an accessible source of both professional and academic inspiration. With this book on the shelves of more students of evolutionary biology, further progress on the theory of levels of selection seems inevitable.