

## NEWS AND VIEWS

## Opinion

# Book review of evolutionary genetics: Concepts, analysis, and practice

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**Abstract**

Recent technological advances have expanded and increased the resolution of studies in evolutionary biology, creating a need for a modern textbook that highlights the latest developments in the field. *Evolutionary Genetics: Concepts, Analysis, and Practice*, by Glenn-Peter Sætre and Mark Ravinet (2019), as well as the book's accompanying online tutorials, provide a clear, up-to-date, and enjoyable introduction to evolutionary biology and genetics that explains fundamental evolutionary concepts, illustrates recent exciting findings, and offers hands-on experience in analysing and interpreting genomic data. The book's accessible nature and emphasis on developing practical skills make it a valuable resource for undergraduate courses on evolutionary biology.

**KEYWORDS**

genetic drift, mutation, natural selection, phylogenetics, population genetics, speciation

It is an exciting time to be an evolutionary biologist. As data sets grow from tens and thousands of loci to whole genomes, our ability to understand the evolutionary history of many species, including our own, is rapidly advancing. We are increasingly able to connect genotype to phenotype for many nonmodel taxa, recognize how the pressures of selection shape those phenotypes, and, among other things, document hybridization in nature. Given the rate at which the field of evolutionary biology is changing, there is a growing need for resources that not only offer an overview of evolutionary principles, but also accurately summarize recent findings. A text that allows students and researchers new to the field of evolutionary genetics to review fundamental concepts, while also providing relevant and up-to-date information on the latest discoveries and methods for analysing genomic data, would be a useful addition to the toolkit of those teaching evolutionary genetics, as well as students beginning graduate programmes in evolutionary biology.

In *Evolutionary Genetics: Concepts, Analysis, and Practice*, Sætre and Ravinet (2019) provide just that. They introduce readers to the exciting and dynamic fields of evolutionary biology and genetics through a series of 10 well-structured chapters, covering topics that range from the organization of genomes and the origin of genetic variation to the process of natural selection, the genomics

of speciation, coalescent theory, and the most recent advances in genome assembly and editing. To accomplish this ambitious task, they draw on classic and contemporary literature to illustrate basic concepts and highlight cutting-edge findings. In addition, they offer students practical experience in analysing and interpreting genomic data through a series of online tutorials that accompany the main text. The clarity of writing and presentation of concepts is consistent throughout the book, and Sætre and Ravinet achieve their goal of not only explaining fundamental evolutionary processes, but also illustrating how these concepts are currently applied in evolutionary studies.

*Evolutionary Genetics* is an accessible textbook appropriate for upper-level undergraduates seeking a contemporary introduction to modern evolutionary biology and genetics. The text is oversimplified at times, beginning with a basic overview of the history of the field and the process of mutation suitable for a general biology course. However, the content gradually increases in complexity to discuss current methods used to generate, analyse and interpret genomic sequencing data. The authors cover essential equations for understanding and modelling evolutionary processes but keep the amount of maths discussed in the text to a minimum, making the content easy to read and digest. In addition, the concepts

presented are supported by an ample array of empirical examples and coherent figures that help clarify the text. Each chapter also includes useful study questions that allow readers to test their understanding of the content covered throughout the book. Although no answers are provided, these questions would serve as a useful resource for early graduate students preparing for their preliminary exams.

One unique feature of *Evolutionary Genetics* is the inclusion of 10 online tutorials designed to provide students with practical hands-on experience analysing published data sets and advance their knowledge of the R programming language. The tutorials assume little programming experience and broadly follow the structure of the main text, including segments on simulating genetic drift, detecting and visualizing  $F_{ST}$  outliers, performing quantitative trait locus (QTL) analysis, and creating and manipulating phylogenies. The use of functions from the TIDYVERSE package may be overwhelming for some newcomers to R and distract from concepts covered in the lessons. Nonetheless, these hand-on assignments serve as a useful introduction to analytical methods and differentiate *Evolutionary Genetics* from similar introductory textbooks by offering students the opportunity to practise manipulating data sets. Unfortunately, the authors only mention the online resources briefly in the preface and on the back cover of the book and fail to integrate them into the main text. Although this leaves professors with the option to incorporate the tutorials into their curriculum should they choose, these valuable resources can easily be overlooked by students reading the book outside of a formal class setting.

*Evolutionary Genetics* covers an impressive breadth of subject matter, including sections on kin selection, species concepts and the evolution of sexual reproduction. However, due to the broad range of topics mentioned, the depth of discussion is limited at points. For example, the authors only dedicate three pages of the book to coalescent theory, a powerful modelling tool that plays a central role in evolutionary genetics. Despite their lengthy examination of hybrid zones and the speciation process, Sætre and Ravinet miss an opportunity to highlight how ongoing hybridization can be leveraged through admixture mapping to identify genomic regions underlying phenotypic traits of interest. Lastly, the authors present a rather one-sided perspective on the importance of homoploid hybrid speciation in nature, a controversial topic that continues to generate debate among evolutionary biologists. These ideas could have been further elaborated to give readers a more balanced and comprehensive understanding of essential concepts. In addition, the text would have benefited from an appendix directing readers

toward common programs and R packages used to carry out some of the analyses mentioned in the text (e.g., generating summary statistics of genomic differentiation and conducting genome-wide association studies [GWAS], ABBA-BABBA tests, and approximate Bayesian computation). While the field is rapidly changing and specific methodological details may quickly become outdated, such an appendix would have served as a helpful guide for readers interested in implementing analyses with their own data. Finally, it is worth mentioning a noticeable skew towards the work of European research groups and institutions in the empirical studies featured in the text; the authors neglect to highlight some outstanding non-European case studies.

In summary, *Evolutionary Genetics* fills a vacant niche in a rapidly advancing field by concisely reviewing the fundamentals of evolutionary genetics and summarizing contemporary genomic findings in a framework accessible to upper-level undergraduates. The broad scope of the book and accompanying online tutorials make *Evolutionary Genetics* most suitable for an evolutionary biology course at the college level. Nonetheless, the book's clear overview of central concepts in population genetics, genomics, speciation, phylogenetics and the history of evolutionary thought will serve as a useful resource for any biologist seeking an introduction to these fields, regardless of career stage. The authors' clear writing and efforts to limit the amount of maths presented in the book to what is absolutely necessary make *Evolutionary Genetics* an enjoyable read that stands out among similar introductory textbooks.

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## REFERENCE

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