

BOOK REVIEW

Molecular markers mature – and enlighten evolution

Molecular Markers, Natural History, and Evolution (2nd ed)

JC Avise

*Sinauer Associates Inc., Massachusetts, USA; 2004. 684 pp.
\$59.95, paperback. ISBN 0878930418.*

Heredity (2005) 94, 382. doi:10.1038/sj.hdy.6800627

Reviewed by GM Hewitt

Molecular approaches now pervade organismal biology, allowing explanations of previously insoluble problems and revealing exciting new paths of enquiry. This is also leading to the closer integration of somewhat disparate disciplines, and in particular those of molecular genetics, population biology, ecology and evolution, and there are few, if any, areas under the broad span of natural history that are not benefiting significantly. This book is intended to serve as 'an educational tool and stimulus for students, and an extensive reference guide for practicing researchers', and seeks to 'document how molecular markers reveal otherwise hidden aspects of behavior, natural history, ecology and the evolutionary histories of plants, animals, and microbes in the wild'. Its achievements are considerable, both in explanatory power and conceptual depth.

The first edition, just 10 years ago, was highly praised by many reviewers. It has been much cited in research papers, and a web search shows that it is used as a core text in hundreds of courses. At that time, following two decades of renaissance in evolutionary studies through the introduction of protein and DNA sequences, the PCR explosion was underway. That has produced many new markers and greatly facilitated the genotyping of many individuals from any species. It is a major task to master and distill the enormous literature that has resulted from this, and we are fortunate to have John Avise to do this in such a balanced and scholarly manner.

This second edition uses the same basic structure as the first, comprising a 'Background' Part I with four chapters that serve to introduce those new to the subject, and an 'Applications' Part II of five hierarchical chapters. These latter chapters explore the value of molecular genetic data in understanding biological diversity at all levels, from individuals, through families, populations and species toward a global phylogeny, and finally in conservation matters.

While the first edition was much praised, it also received some criticism, particularly for the Background section on methods of analysis. The explosion of molecular data has caused a rapid growth in such methods, and this advance continues. This topic has been revised considerably and makes suitable reference to specialized texts. Furthermore, the Background chapters are intended as an introduction to later chapters, and they serve this purpose well. But they also carry in them the philosophy of joined-up science, from molecule through populations to speciation and phylogeny, with applications to behaviour, ecology and evolution. The second edition now has

genealogy at the core of this understanding, and extends Dobzhansky's dictum with 'much in evolution makes even more sense in the light of historical genealogy'. This consideration of history also engenders a nonequilibrium view of ecology and evolution, from variations in gene frequency to the legacy of ice ages.

Other major attributes of this book are its sense of balance and empiricism. The Background chapters on the history of genetic variation, molecular techniques, and philosophies and methods of molecular data analysis all place their topics in an historical context, which makes the present state more understandable and educates in the nature and process of science. It is nice to see such source references as Darlington (1939) and Muller (1950), and this regard for history permeates all sections, from human forensics to ancient genome endosymbiosis. Balance is also very evident in the treatment of major disputes like those concerning neutrality and selection, molecules and morphology, phenetics and cladistics, or allopatric and sympatric speciation. The last 10 years have provided more evidence to clarify these, and the new student may be spared the tortuous decades of polemics. The Applications chapters use a plentiful supply of examples to present and discuss their concepts and hypotheses, from parentage through population structure and phylogeography, to speciation and phylogeny. There are now some 4400 references running into 2003, and these provide an extremely valuable resource for student and master alike. The distillation of the experimental results is pertinent and cogent, and, as many tutors agree, instruction by case studies is most effective.

Despite some deletions, this new edition has increased from 511 to 684 pages, partly due to new material and partly due to a larger type set and figure design, though I am sorry that the quaint original drawings are gone. Within this structure, there are many rearrangements of sections, sentences and headings, and the text has been fine-tuned to convey facts, arguments and concepts more easily. Even the preface to the first edition has been polished. One is reminded of the many crumpled pages of discarded writing that littered the floor when Dylan Thomas was re-revising a poem in Laugharne, all unseen in the rush of colour and fancy of the final version. For me, one of the best features of this book is its simple yet learned writing, which effortlessly takes one from raw data to an understanding of fundamental evolutionary processes, and this clarity promotes one's own thoughts and ideas. This is particularly valuable for students, whose intellectual development is eased, guided and accelerated by the style and content of the book. It will educate all students, and challenge and inspire the best.

I shall recommend this 'renovated' edition to my students, and my colleagues, as a book anyone seriously interested in evolutionary biology should read. With this as a core text, one may supplement one's own specialties, be they sperm competition, hybridization, island speciation or Quaternary range changes! This matured treatise marks a milestone in our path of evolutionary enlightenment.

GM Hewitt

*Biological Sciences, UEA, Norwich, NR4 7TJ, UK
E-mail: g.hewitt@uea.ac.uk*