

BOOK REVIEW

Evolutionary genetics: from molecules to morphology

Edited by Rama S. Singh and Costas B. Krimbas

Cambridge University Press, New York; 2000; 720 pages; \$95 (UK edition £65)

Reviewed by N. V. JOSHI*

This is a collection of 32 articles, produced in honour of Prof. Richard Lewontin on the occasion of his sixtyfifth birthday. It is difficult to think of a better collection of comprehensive, timely, up-to-date, perceptive and highly readable reviews spanning the entire spectrum (from genes to societies) of evolutionary studies. But, then, nothing less would be acceptable for a volume in honour of Prof. Richard Lewontin: no reader of *Journal of Genetics* would be unaware of his very profound influence on every aspect of evolutionary biology during the last four decades.

One of the most distinguished scientists of late eighteenth and early nineteenth centuries, Sir Humphry Davy, the most famous chemist in Europe during those years, discoverer of sodium and potassium, and founder of the field of electrochemistry, is said to have described Michael Faraday as his greatest discovery. In the same spirit is the quotation from Th. Dobzhansky reproduced at the beginning of the book: '[I]f I would not do anything else but to produce ... Dick Lewontin ... , I think my earthly existence would be justified.' An exaggeration? Most certainly not—for this is how the editors most appropriately introduce Richard Lewontin (and I can neither resist nor do better than quoting them at length): 'Scientists earn their reputation by making special contributions in a variety of ways. Some become known for a discovery that revolutionizes their science. Others are respected as intellectual leaders for significant contributions leading to sustained progress in their field. Still others become known for providing guidance and opportunity to and uniquely inspiring rapport with a large number of graduate students, writers and research colleagues. A rare few do all the above, and remarkably enough still find time to deal with the broader issues of epistemology, philosophy, history, and sociology of science. Richard Lewontin is one of these rare scientists.' In fact, even a cursory look at the list of over 200 publications (in four or probably

more languages) provided at the end of the book is enough for the reader to appreciate the depth and breadth of Lewontin's scientific productivity, creativity and flair for writing. Beginning in 1952 with a review of the 'text-book of evolution', one finds more than half a dozen contributions 'in press' or 'in preparation' even in 1999—the most recent one with the intriguing title 'Does culture evolve?'. In the course of these 47 years, one finds articles on a really wide range of subjects: topics of biomedical interest ('familial occurrence of migraine headache'), genetic models ('a general method for investigating the equilibrium of gene frequency'), statistical theory ('the goodness-of-fit test for detecting natural selection'), down-to-earth bench-work ('cytogenetics of the grasshopper') and so on in technical journals together with perceptive commentaries on esoteric ('models, mathematics and metaphors'), controversial ('race and intelligence', 'menace of the genetic-industrial complex') and sensitive ('women in science', 'science as a social weapon', 'the problem of Lysenkoism') themes addressed to a more general audience. It is his writings in this latter category that seem to have prompted Prof. John Maynard Smith to point out (in his inimitable way) that Lewontin has also contributed to science 'by asking us to think about the relationships between the sciences that we do and the world that we do it in'.

Moving now to the contents of the book, one finds (quite fittingly) the very first essay to be on 'The problems of population genetics' by Lewontin himself. As expected, it is a masterly exposition of the topic, and the imaginative diagram (also reproduced on the cover) depicting within-generation and between-generation transformations as well as the transformations within and between phenotype and genotype spaces provides an excellent framework for a concise and precise description of the problems associated with the various features of the dynamics of gene frequencies. As always, one not only marvels at the incisive analysis of the current state of the subject, and benefits from the suggested research agenda for the forthcoming decades, but also enjoys the skilful prose replete with highly quotable phrases like

*Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, India.

'self-terminating research program' and 'intellectual division-of-labour in biology'. Anyone embarking upon serious analysis of DNA sequence data (or genomics, to use the fashionable word of the day) would do well to study this chapter.

The 32 articles in this book have been conveniently and logically divided into eight sections. Each section begins with a very readable and succinct 'introductory remarks', almost always written by an author of one of the articles in the section. The sequence of the sections has also been logically organized, from the most basic ('population genetics: problems, foundations, and historical perspectives', including, for example, an article on the mathematical foundations of population genetics by Warren Ewens) to the most complex ('Behaviour, ecology and evolution', including an essay on attitudes to animal behaviour by John Maynard Smith). In between, we have sections on molecular variation and evolution, followed by one on selection and genetic polymorphism, leading to the more technical sections on linkage, breeding systems and evolution, followed by quantitative genetics and phenotypic evolution. The next two sections are larger in scope, the first one dealing with gene flow, population structure and evolution and the next one with the more difficult population genetics and speciation.

Many of the articles are written by well-known authorities in the field (Bruce Wallace, Marcus Feldman, Brian Charlesworth and Joseph Felsenstein to name a few, apart from the ones mentioned earlier). Though most of them are comprehensive overviews, one does come across quite a few new insights. The errors and limitations in the works of the three great masters of population genetics theory (Haldane, Fisher and Wright) discussed by Ewens is a case in point. Also interesting is his observation that these three masters were in complete agreement that the process of natural selection is adequately fast for the 'amazingly intricate adaptations that we see in the living organisms today' to have arisen during the lifetime of the planet. Rama Singh's proposal for a unified theory of speciation introduces a novel, generalized multidimensional gene pool concept, and is also very articulate about the inherent problems: 'evolutionary relationship among genetical, morphological and ecological changes during the early stages of speciation is indeterministic and unresolvable...'. In addition to being very informative, many of the articles are also a delight to read, as seen from this snippet from Bruce Levin: 'In

this chapter, I have tried to illustrate (proselytize) that antibiotics resistance poses problems that are intriguing, even from the precious perspective of academic populations...'. Joseph Felsenstein's 'personal and impressionistic account of the situation in evolutionary genetics' (including a cartoon of a monster, and the revelation about the acronym NSF standing for Not Sufficient Funds) is not to be missed. Another 'compulsory reading' for all the students of evolution is the gem by John Maynard Smith on 'Attitudes to animal behaviour'. If only his clarity of thought and expression was more common in sociobiologists, the resistance to their ideas would have been far less, and the understanding of these ideas much more widespread. His analysis of how the idea of the evolutionary basis of a female choosing her mate was viewed by others has to be read in full, but here is a glimpse:

'A serious weakness of Darwin's theory of female choice was his failure to offer an explanation of why females should choose. Instead, he left female choice as a matter of aesthetic taste. There is a reason why he should have been satisfied with this explanation...'

'The hostility to the notion of choice was, I think, based on a misunderstanding, though in an absence of a selective explanation for the choice it was perhaps an excusable one. Choice was taken to mean a process of conscious deliberation on the part of the animal, analogous to the process whereby a woman might decide to elope with her lover rather than marry the wealthy prospective husband favoured by her family. But an animal can possess a structure or behaviour that makes it more likely to mate with one kind of male than another. That is all that is required to cause selection on male traits: Whether the animal is aware of what it is doing is a separate and much harder question, which we do not have to answer ... there is no need for the most mechanistic biologists to reject the notion of choice.'

While one can go on quoting from this and other articles, it is neither possible nor appropriate to do so in this short review. The editors deserve congratulations for producing a superb volume of lasting value.

To sum up: any library that caters to students and researchers of evolutionary biology must acquire this book. In fact, probably no evolutionary biologist (and more importantly, no one working in the field of bioinformatics) can afford not to have this compilation in his or her collection.