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Book reviews

Genetics of Populations (2nd edn). Philip W. Hedrick. Jones and Bartlett Publishers, Sudbury, MA. 2000. Pp. 553. Price £26.99, hardback. ISBN 0 7637 1076 8.

Some years ago, population genetics was an esoteric discipline, apparently relevant only to those interested in developing a rigorous theory of how evolution occurred. Most biologists were happy to work within an evolutionary framework dominated by verbal descriptions of neo-Darwinism and Natural Selection. The molecular revolution of the past 20 years has had at least two consequences relevant here: firstly, all of biology has now become a subset of genetics, with the majority of disciplines using molecular genetics techniques to test hypotheses; secondly, many of these disciplines are explicitly or implicitly using methods or assumptions rooted in population genetics theory as standard techniques within their work. There is thus a great need for population genetics texts that are accessible to all biologists who wish to understand the background to the methodology they use.

This book is a new edition, which has been revised to incorporate some of the recent ideas emerging from the molecular revolution, while still providing the traditional theory underpinning the techniques. The major topics covered include; measures of diversity, selection theory, inbreeding, genetic drift, effective population size, gene flow, population structure and metapopulations, mutation, molecular population genetics (including phylogenetic tree building), multiple gene models and linkage disequilibrium, and quantitative genetics (including modern QTL techniques).

It is probably rare to read this sort of book from cover to cover, as a reviewer is expected to do. At the end of the introductory chapter, which is intended to provide an overview of the text, I was irritated by minor errors and simplifications and was beginning to form a negative image of the book, and framing a negative review. As I read further, I revised my initial opinion, and was increasingly impressed. The book covers a wide scope and marches through the various topics at a good pace. I might have given greater emphasis to some topics and queried the arrangement of others (for instance why is the discussion of self-incompatibility alleles not included with that of frequency dependent selection?) but that is a matter of taste and judgement. What is good is the mix of mathematics and example. Sufficient theory is included to provide rigour and the theoretical basis of the subject. This theory is developed at a level which should be accessible to the average numerate biologist. The theory is flashed out by a series of examples, separated from the text in boxes, which use real data to illustrate techniques or principles. These examples are generally interesting and well chosen. The weakest part of the book is probably the treatment of quantitative genetics, which neither is sufficiently detailed to provide a good grounding in the traditional analysis of heritability, nor sufficiently introduces the principles and limitations of quantitative trait locus (QTL) mapping.

So who will buy this book? The preface suggests that it is designed for graduate students and advanced undergraduates 'who have had a course in genetics or evolution *and* have an aptitude for quantitative thinking' (my italics). I think this is an accurate descriptor. I could not use this as a standard undergraduate text in Britain because the level of algebra required would be beyond the competence of the average Biology student. As a library resource, it is excellent. I could certainly imagine using it as a core text for a postgraduate (MSc or PhD) taught course: I fear these are too rare to make the fortunes of author or publisher.

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The Triple Helix — Gene, Organism and Environment. Richard Lewontin. Harvard University Press, Cambridge, MA. 2000. Pp. 136. Price £14.50, hardback. ISBN 0 674 00159 1.

Back in the 1960s, Richard Lewontin was one of the first to use the technique of protein gel electrophoresis for assessing levels of genetic variation in natural populations. It was nothing short of a revolution in population genetics. Yet writing some 30 years later, Lewontin has a less rosy view. 'The result [of protein electrophoresis] was an almost universal abandonment of the research in all aspects of evolutionary genetics other than the characterization of genetic diversity. A single easily acquired technique changed and pauperized … an entire field of study'.

This book is Lewontin's attempt to tell us what evolutionary biology has been lacking all these years. The message is simple and inescapable: only by looking at the context in which biological traits are expressed can we fully understand the complexity of evolution. Put another way, biology is messy, but it is the mess that is important. This is not a new idea, or even a plea for a new methodology, just an eloquent and dogged iteration of a biological truth. The question is, is it a useful truth? Lewontin is very keen to tell us about the limitations of a reductionist approach and cites plenty of examples where a blinkered gene-by-gene paradigm cannot make sense of biology. But, he is less good at telling us just how we should alter our perspective. About the closest he gets

is when he writes: 'It is not new principles that we need but a willingness to accept … that biological systems occupy a different region of the space of physical relations than do simpler physico-chemical systems'. In short, biology is not physics. I cannot accept this as a useful statement for two reasons. Firstly, it is true to the point of platitude. Secondly, we can learn a lot about biological systems by pretending they do follow simple laws — it is the basis of both population genetics and theoretical ecology. When biology doesn't fit (as is usually the case) we are forced to find out why. Without the reductionist approach we cannot work out what the questions are.

Reading *The Triple Helix* is rather like being told off for something but not being sure what it is. Lewontin acknowledges that much of the book has 'a distinctly negative flavour' and makes an attempt in the last chapter to be more constructive. However, his solution to the problem of how to think about biology in terms of wider contexts is essentially just that of the reductionist — to identify semi-independent sub-systems and work within these bounds. Yet this is just what biologists do all the time. Nobody studies a gene nucleotide by nucleotide. We do not consider each feather in a peacock's tail as an independent unit. Biology is nothing but the study of how complex traits are made up of many small details. It is the level of our understanding that dictates the focus of current research. Adjust the focus either way, and the picture becomes blurred.

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Cancer: The Evolutionary Legacy. Mel Greaves. Oxford University Press, Oxford. 2000. Pp. 271. Price £19.99, hardback. ISBN 0 19 262835 6.

Everyone (including geneticists) should know about cancer. After all, as our society becomes better at curing the really big current killers, such as heart disease and infectious diseases, cancer is much more likely to kill us in our old age. The problem is that cancer is now such a terribly complicated set of diseases that simplistic thinking and analysis are no longer enough. It needs a good and lucid intellect to explain it, even to geneticists, and in Professor Greaves an able communicator has been found. I have read many 'popular' cancer books, some with a multitude of colour illustrations to make their point (and to relieve the complexities), but rarely have I actually enjoyed the read.

This small and sparsely illustrated volume held my attention, and actually demanded a re-read to check on the bits I missed first time through. There was even humour to lighten the load. The account of increased cancer risk from smoking was considerably enhanced (without losing the serious message) by quotations from Bob Newhart's sketch on tobacco (or 'civilisation' as it was known at the time!). We are even presented with a glowing example of Bernard Levin's prose on the subject of smoking. I hope that the contemporary writings of John Diamond, also of *The Times*, (who is under treatment in Professor Greaves' own Institute) could be included in a second edition.

But there is a serious side to it all. This erudite text explores cancer as a genetic disease and ultimately as an example of natural selection. This could descend, as it often does in plenary lectures, into an extensive list of cancer-associated genes and/or an account (suitably neutral in tone of course) of the lecturer's own area of research. Not so. This book is a balanced and selective account, using common examples, rather than an overwhelming encyclopaedic approach. True, the nit picker may find omissions, but as a whole the subject is conveyed with wit, fluency and authority.

The concept that our uncoupling (to coin a phrase) of sex for reproduction from sex for pleasure lies at the heart of the two biggest gender-specific cancers (breast and prostate) is a particular theme. Man's foolishness in other areas such as his 'modern' diet and treatment of the environment rightly do not escape the caustic treatment of Professor Greaves' pen. The comparison between cancer incidences past, present and future should give us plenty of food for thought.

Although not a text book, I would rate *Cancer: The Evolutionary Legacy* an essential read for new graduate students, undergraduates in a specialist cancer option, medical practitioners wanting to update their medical school oncology … and even tired old geneticists. In these days of information overload and deep specialisation, the next generation of cancer researchers frequently become obsessed with the leaves on the trees, while never glimpsing the wood or the forest! Here is the problem in 271 pages. It is not until page 218, that the cause of cancer is defined in the following two sentences: 'So no, it isn't your job, your stressful lifestyle, your genes, your diet, just bad luck, or an act of God that's to blame: a multi-layered web of exposures and modifiers is involved. And, by and large, this network is a construct of very long-running evolutionary contests and problem solving, human history and social engineering – heavily garnished in more recent centuries and decades with commercial and political imperatives, and pervaded throughout by chance.'

Yes it's complex, and although the disease has been with us for a very long time (here beautifully put into historical context), it can rarely have been described with such aplomb.

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