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Book reviews

Molecular Approaches to Ecology and Evolution. R. DeSalle and B. Schierwater (eds). Birkhäuser Verlag AG, Basel. 1998. Pp. 364. Price DM 88.00, paperback. ISBN 3 7643 5725 8.

This collection of 17 wide-ranging articles shows the remarkable applicability of molecular approaches to many aspects of ecology and evolution. The articles are all in the format of reviews and grouped into three sections: part 1 on population biology, kinship and fingerprinting, part 2 on species and part 3 on higher taxa and systematics. Within part 1, the advantages and pitfalls of microsatellite analysis are well-covered with two reviews (Schlötterer and Pemberton; Rosenbaum and Deinard) while Caetano-Anollés describes an extraordinary array of approaches to reveal alternative polymorphic markers using arbitrary oligonucleotide primers (RAPDs and the sons and daughters of RAPDs). From a more conceptual angle, the three remaining articles in part 1 describe how a variety of different molecular techniques have helped in studies of kinship and reproductive success in insects and birds (Webster and Westneat; Siva-Jothy and Hadrys; Scott and Williams).

Part 2 opens with two articles on the use of molecular data to distinguish between different speciation models (Templeton; Wakeley and Hey), and then Amato *et al*. and Vogler show how molecular markers can aid in decision-making in conservation biology. The model bacterial species comparison between *Eschericia coli* and *Salmonella enterica* (serovar Typhimurium) is discussed in molecular terms by Ochman and Groisman, while Routman and Cheverud emphasize the value of quantitative trait loci in speciation studies. Part 3 has three articles relating to molecular data analysis (Wheeler; Golstein and Specht; Larson) the last of which considers the vexed question of how to combine molecular and morphological data sets. Of the final two chapters, I particularly enjoyed that by Cunningham and Collins who review what is known about the faunal interchanges between the Pacific and the Atlantic, and the value of molecular markers in analysing these. In contrast, the developmental genetics considered by Jacobs *et al*. stands out rather uncomfortably as covering distinctly different material from the rest of the book.

The articles are well-written and well-referenced (up-to-date until 1997) and I found that reading the book from cover to cover gave an interesting perspective of the field. The book is not intended to be comprehensive (there are some huge gaps, e.g. molecular clocks, comparative genomics, ancient DNA) and cannot be used as a core text for teaching molecular ecology and evolution, but will be genuinely useful for supplementary reading. The editing is light which leads to some repetition among articles and some inconsistency in the use of acronyms. While on the subject of acronyms, this book really illustrates the extent to which this field is swamped with them. Whatever Rosenbaum and Deinard's concerns, let us have 'microsatellites' instead of 'SSRs' and 'STRs', and let 'ASAP' stand for 'as soon as possible' rather than 'arbitrary signatures from amplification profiles'!

It should be noted that this book has a more substantial 1994 predecessor [*Molecular Ecology and Evolution: Approaches and Applications* (B. Schierwater *et al*., eds) pp 622]. All but two of the articles in the new book are by authors who wrote articles in the previous one. Most of the authors have produced a radical revision of their previous work or a completely new piece, but five of the articles in the new book are very similar (albeit updated) versions of articles in the old one. So, if you have the old volume, think twice before buying this book. If you don't have the old volume, I would recommend DeSalle and Schierwater's book as an enjoyable sampler of the field of molecular ecology and evolution.

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Interpreting DNA Evidence: Statistical Genetics for Forensic Scientists. Ian W. Evett and Bruce S. Weir. Sinaur Associates Inc, Sunderland, Massachusetts. 1998. Pp. 278. Price £25.95, paperback. ISBN 0 87893 155 4.

This book sets out to provide the statistical and genetical knowledge that forensic scientists require to report and testify about DNA profiling evidence. In doing so it tells a story of much broader interest. DNA evidence can be both very strong and quantifiable, yet these apparently useful properties have exposed and challenged the way in which scientific evidence is presented and decisions are made in court. How can a court weigh the impressive odds given to explain the strength of the DNA evidence with the more conventional evidence?

Evett and Weir illustrate the issue using the case of *R* vs. *G. Adams*. In outline, the case involved a rape by a stranger. A suspect was identified by a DNA profile match with a sample obtained in connection with another incident. This suspect, Adams, had an alibi for the night of the attack. He was not picked out in an identity parade by the victim, indeed she said at a later hearing that he did not look like her attacker and that he was appreciably older. The presentation of the evidence was understandably problematic involving retrial and appeals. How could the jury compare the unquantified evidence suggesting innocence with the odds calculated from the DNA evidence suggesting guilt? At retrial prosecution and defense experts cooperated in a remarkable innovation. They guided the jury in the calculations needed to express the

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identification and other non-DNA evidence in numerical form, thereby allowing direct comparison with the DNA evidence. Adams was again convicted, but at the subsequent (unsuccessful) appeal the judges recommended that juries should not normally be induced into numerical reasoning. This leaves the problem of how to present the DNA evidence to the court so that it can be evaluated appropriately by common-sense.

The books leads up to these difficult and incompletely resolved problems. It starts by laying the necessary foundations in probability and population genetics. The authors take the view that forensic scientists are 'often uncomfortable with statistics' and so start from fundamentals such as the meaning of randomness and probability. This allows them to introduce Bayesian analysis to forensic inference. This will be a big jump for their target audience. Most of them will have been trained to assess data in the classical statistical mode, to evaluate the probability of the evidence under the assumption of some null hypothesis; in this case the null hypothesis might be that the suspect did not leave the crime stain. They advocate assessing, instead, the effect of the genetic data on the relative probability of the hypotheses of interest to the court; perhaps the hypothesis that the suspect left the stain compared to the hypothesis that some other person did.

The first two chapters of the book appear to have been very thoughtfully constructed; they provide the necessary tools and background to make the difficult conceptual jump between the classical and Bayesian mode of reasoning. They use examples from forensic science at an early stage, avoid distracting issues and write clearly. The middle of the book necessarily becomes more densely written in order to cover the range of problems that occur in practical casework and will perhaps be more useful as an expert training text.

The final chapter will again be of wider interest and is particularly stimulating. The importance of introducing the Bayesian approach is illustrated by the problem of a suspect identified by a search through a database. At first sight it seems reasonable that the evidence against a suspect is weaker if he is identified in this way; after all forensic databases can be quite large (the UK database may eventually contain over a million people). Even if match probabilities are several million to one, the chances of one innocent person matching in a large database may be non-negligible. For this reason a US National Research Council recommended that a diminished strength of evidence should be represented by multiplying the match probability by the database size. The arguments of Balding and Donnelly show this to be logically flawed: imagine the database being extended to cover almost every likely suspect in the country, surely as the database gets bigger the single matching person is more likely to be the true culprit, not less! The book outlines how the Bayesian approach resolves this paradox in a straightforward manner.

What the Bayesian approach cannot resolve is the tricky issue of ensuring that the court reasons sensibly with the information provided to it by the experts about DNA profiles. They provide examples of expert testimony to courts which are logically incorrect (which may be regarded as grounds for appeal). On the other hand they present superficially similar wordings about the same evidence which are correct. They report that a judge has confided that, if the differences between the correct and incorrect sentences is so subtle, then perhaps the fallacy doesn't matter. Alternatively it may be that there are as many problems with courts trying to apply common-sense to reasoning about forensic data as there are with introducing numerical reasoning about the other evidence.

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The Human Genome: A User's Guide. R. Scott Hawley and Catherine A. Mori. Academic Press, San Diego. 1998. Pp. 415. Price $49.95, paperback. ISBN 0 12 333460 8.

The aim of this book is to inform members of the public about the implications of human genome research. In addition to giving an accurate explanation of the working of the human genome, it explores the personal issues arising from the implementation of genetic technology. Topics covered include the basic mechanisms of heredity, gene structure and function, Mendelian inheritance, mutations, sex determination, failure of meiotic mechanisms, human genes and molecular biology techniques and genetic–environmental interactions.

The text is made more interesting with both scientific snippets and personal anecdotes. Examples of these are the tales of two men with Klinefelter syndrome and the evidence for one gene encoding one protein. The book is not afraid to tackle controversial subjects, like the inheritance of aggression, and also covers a wide variety of topics that members of the public may encounter for themselves. For example, testing for Down's syndrome, or realizing that you yourself are at risk of breast cancer following diagnosis of this disease in your mother and sister. On the downside, the book jumps around rather too much, and the examples given are often unusual cases of genetic conditions — perhaps that is part of its appeal.

A passing urologist, Leslie Moffat, saw the book lying on my desk and asked to borrow it. I explained that I had it for review — he offered to take a look. For the next month I received regular calls, 'please can I keep the book a bit longer?' These are his comments. 'This is a refreshing text which puts modern genetic techniques into a readable form making them intelligible even for a surgeon. The descriptions of genetics do not assume a high entry level, and yet move at a measured pace into complex issues. The whole field of genetic research is pursued in sufficient detail for a nonspecialist, and then signposts the path to further knowledge. The descriptions of laboratory tests are particularly lucid and Section V deals with the interactions of genes and the environment in a sufficiently effective manner for a general publication. An epilogue on eugenics rounds off a mature assessment of the role of scientists in ethical issues. Further reading is suggested and