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Book Reviews

DNA on Trial: Genetic Identification and Criminal Justice. Edited by PAUL R. BILLINGS. Cold Spring Harbor Laboratory Press. 1992. 154 pages. $55.00. ISBN 0 87969 379 7.

This book has a very misleading title, since it is certainly not DNA that is on trial, but the application of the DNA Fingerprinting technique developed by Alec Jeffreys to criminal cases in the USA involving mainly rape or rape and murder. This technique is designed to show a match (or absence of match) between a suspect's DNA and semen or blood not belonging to the victim found at the crime scene. The match is based on comparing the DNA profiles of the two samples from a small number of VNTR loci. If they do match, there is a very high probability that the suspect is responsible for the semen sample, since the chance of another man having DNA with the same profile is extremely low – because of the very large number of possible alternative profiles.

Two main arguments favouring the defence when a good match is found have been put forward. (1) Errors in processing the suspect's DNA sample by the forensic laboratory have in some cases been found, and (2) the odds against two men (the suspect and another man in the relevant population) having the same DNA profile are, or may be, less by several orders of magnitude than those usually calculated by the prosecution. The argument in these cases centres on the question of precisely what is the population of men, and hence the statistical distribution of DNA profiles, to which the suspect belongs.

These arguments appear to have been put forward with the aim of helping the defence, so it should be pointed out that, in the case of (1) above, any error in the forensic analysis of the DNA from the crime scene or the suspect would almost certainly not produce a match between the two profiles when the two correct profiles would not have matched, so an error in producing a DNA profile could not give a false positive match. A false positive could only occur if the forensic laboratory had run the same DNA sample as both that of crime scene and suspect, which would imply an intended error and might be obvious to the expert eye.

Arguments on point (2) continue and have involved a number of population geneticists. *Science* Vol. 259, pp. 748 and 755 (5 February 1993), give the latest arguments and a list of papers still in press, all much more up-to-date than will be found in the book under review. From these it is clear to me that any disagreements remaining should not affect a court's judgement, though they may still do so because of the complexity of the statistical arguments. Thus a leading British defence lawyer is reported to have said at a recent discussion meeting that the use of so-called DNA fingerprinting is one of the most dangerous developments in criminal trials in recent times, because there is a danger that the claims by proponents of DNA profiling – in which complex tests of genetic material in blood or tissue are used to identify offenders – are such that they may usurp the function of juries, who could generally not understand such complications, contrary to the principle that they should evaluate the evidence as the ultimate bulwark against injustice. The ability of the defence to evaluate DNA evidence is also limited by technical factors and costs, and in Scotland by the trend to place DNA laboratories under Police control – a development which I strongly agree with him should be reversed.

Getting back to this book, it came out of a symposium at the 1991 meeting of the American Society for the Advancement of Science, with help from the Human Genetics Committee of the (American) Council for Responsible Genetics. Most of the chapters deal with the history up to 1992 of forensic use of DNA profiles in American courts, mixed in with turgid if not really obscure sociological analysis of the development of present legal attitudes. Such subheadings as 'Procedural Truth over Authoritative or Expert Truth', 'DNA Identification Implicates the Basic Legal Norms', 'DNA and Procedural Rather Than Substantive Truth' leave me a little baffled. But the court cases are certainly of some historical interest, and I liked particularly J. Baird's article, with its description, among other cases, of State v. Mr Y. The reader will note the appearance here of three expert defence witnesses. These had been advising judges around the country to exclude DNA fingerprinting from criminal trials for as long as this type of evidence had been available. None of them had ever produced a VNTR autoradiograph or published an article in a peer-reviewed journal on any topic remotely analogous to their

courtroom testimony. They spoke 'in the embittered tones of unacknowledged prophets' – and earned considerably more per year in expert witness fees than from their academic salaries or from any other source of income. I should point out, however, that such witnesses, who are likely to be accepted as experts by the court, may be the best or only ones that the defence can obtain and may well perform a useful function.

Two chapters, though somewhat out-of-date, are worth attention: Bruce Budowle's FBI forensic team on 'Reliability of Statistical Estimates in Forensic DNA Typing', and Donald A. Berry's article on 'Statistical Issues in DNA Identification'. The latter discusses *Bayes' Rule*, proposed by an English mathematician who died in 1761 and now important in DNA profiling statistics. Jeroo S. Kotval's chapter 'Public Policy for Forensic DNA Analysis: The Model of New York State' emphasizes the concerns which non-geneticists have expressed about recent trends and dangers. 'The track record of the FBI in the area of respect for civil liberties and the public's unease about the possible misuse of stored DNA in the possession of an investigative agency are legitimate concerns of public policy', he writes, and he strongly favours national legislation to forbid the banking of DNA samples taken for investigative purposes and/or the use of these samples for any other tests.

The last three chapters take the civil liberties theme further. Philip L. Bereano discusses 'The Impact of DNA-based Identification Systems on Civil Liberties'. Troy Duster writes about 'Genetics, Race, and Crime: Recurring Seduction to a False Precision', and Nachama L. Wilker, Steven Stawski, Richard Lewontin and Paul R. Billings present the current thinking of the Human Genetics Committee of the Council for Responsible Genetics on issues related to the storage and use of genetic information, in the final chapter of the book, entitled 'DNA Data Banking and the Public Interest'. Remembering the enthusiasm of many leading western geneticists in the recent past for utterly outrageous public policies of applied genetics – so-called eugenics – geneticists should lead the way in helping other civilized people to prevent similar developments from happening again.

In conclusion, I think there is much of importance in this book, to everyone except, perhaps, a prosecuting attorney.

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In situ Hybridization. A Practical Approach. Edited by D. G. WILKINSON. IRL Press, Oxford. 1992. 163 pages. £18.50 Softback. ISBN 0 19 963327 4.

This excellent little primer describes the commonly applied methods of detecting nucleic acids in cells and tissues by *in situ* hybridization. It begins with a very useful overview of principles and practice (Wilkinson). This is followed by chapters on applications of the technique to tissue sections using, as probes, radiolabelled RNA (Angerer and Angerer), oligodeoxynucleotides (Young), and biotinylated DNA, RNA, and oligos (Emson and Gait). *In situ* hybridization to whole embryos is described in two chapters relating to *Drosophila* (Tautz *et al.*) and vertebrate embryos (Wilkinson). There are chapters on simultaneous detection of RNA and protein in tissue sections and cell suspensions (Brahic and Ozden), applications in electron microscopy (Binder), rapid detection of viral DNA in cell smears, and in frozen, and paraffin, sections (Lewis and Wells), and on the localization of DNA sequences on chromosomes, banded and unbanded (Viegas-Pequignot).

The style is simple and direct with sufficient detail and emphasis on technical controls to put sound results in the grasp of anyone without specialized knowledge; indeed, even experts will find a profitable sprinkling of technical tips. The layout is pleasant and well designed: comprehensive step-by-step protocols are interspersed with explanations capped with short lists of well-selected references. The functional index is adequate for a well-organized book of this size.

I have only two criticisms. The first concerns safety: a pointed indication of the dangers in using, and disposing of, radiolabelled materials would have been pertinent in a book targeted to postgraduate students and relatively inexperienced workers. The second point relates to one of the main advantages of non-radioactive *in situ* hybridization, its potential for cellular localization. *In situ* hybridization to whole embryos gives an excellent view of the overall distribution of target sequences. That is fine for *Drosophila*. But for structures as complex as, say, a 9-day mouse embryo we are left with the frustrating difficulty of determining which tissues and cells are labelled in whole-mount preparations. It would have been worthwhile to give some consideration to the ways round this problem, by clearing, dissecting, or sectioning stained specimens or by using confocal microscopy in conjunction with fluorescent probes, to 'optically section' the specimen or deconvolute the signal.

But these criticisms should not discourage the aspiring hybridizer from buying what seems to me the best book of its kind on this popular technique.

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