

## BOOK REVIEW

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### Review of: *DNA: Forensic and Legal Applications*

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**REFERENCE:** Kobilinsky L, Liotti TF, Oeser-Sweat J. *DNA—Forensic and legal applications*. John Wiley & Sons, Hoboken NJ, 2005, 364 pp., ISBN 0-471-41478-6, \$89.95.

This book, by a forensic science educator and two attorneys, sets out to cover a lot of ground—a complete summary of the science and the legal issues surrounding forensic DNA typing. There are seven chapters, and seven appendices, the last of which is the book index. Chapters 1 through 4 are concerned with DNA science. Chapters 5 through 7, and appendices B through F, are concerned with legal matters.

A foreword by James Watson and Jan Witkowski at the Cold Spring Harbor Lab makes extended reference to the 1988 Banbury meeting, and notes that a man exonerated by DNA typing was able to address the 50th anniversary of the double helix party in New York recently. It is noted that Sir Alec Jeffreys, widely acknowledged as the originator of forensic DNA typing, was present at both events.

Chapter 1 provides background information on DNA structure and replication, and on genetics. It also includes a section on the evolution of “identification,” meaning human identity in this context. The evolution discussion includes examples from pattern evidence, such as footwear impressions, tool marks, tire tracks, and fingerprints. A footwear impression match is called a “physical match” at one point, but later, correct examples of jigsaw fit physical matches are cited. There is discussion of fiber matching in the Wayne Williams case, hair comparison by morphology as well as by DNA typing, and even a commentary on the bloody gloves from the Simpson case. Fingerprints and AFIS are discussed in some detail. This section would have been more cohesive without the references to non-fingerprint pattern evidence, fibers, hairs, and the Simpson glove example. The authors suggest that DNA evidence is superior to fingerprint evidence because the former is more likely to be present, or more likely to be found and analyzed. Latent print analysts would probably disagree, and there isn’t any definitive research on the frequency of cases that have probative DNA vs. probative fingerprint evidence.

Chapter 2 discusses biological evidence in the context of crime scenes and investigations, and delves into what today is often (and no longer properly) called “serology.” It probably should be called “preliminary examination and identification” of biological evidence. The goal of the terminology is to distinguish between

preliminary and identification tests on one hand, and DNA typing on the other. Prescriptions for crime scene investigation are pretty standard, including scene security, documentation, systematic search patterns, etc.

It is strongly suggested that biological evidence be stored cold or frozen as soon as possible, and even that portable cold storage might be useful at scenes. There is nothing wrong with storing biological evidence cold, but particularly with DNA, it could well be that the evidence is just as stable at room temperature provided it is thoroughly dry. In the discussion of collecting sexual assault evidence, the authors still talk about collecting whole blood from complainants. There doesn’t seem to be any reason to collect blood any more, when a buccal swab does just as well, is more stable for a longer time if dried, and is considerably less intrusive to collect.

The biological evidence identification discussion talks about both presumptive (catalytic) and confirmatory tests for blood and for the most commonly submitted body fluid specimens. Crystal tests for confirming blood identity have not been widely used for quite some time. Crystal tests for semen identification are mentioned as well, and they are now of purely historical interest. Species testing by gel methods is discussed, along with the usual tests for the identification of body fluids other than blood. Many labs will probably be turning to RT-PCR for species testing (along with human DNA quantitation) soon, and the authors point out this trend. It is noted that microscopical hair comparison should be seen as a screening test now, a proposition with which most criminalists would agree. This chapter concludes with chain of custody requirements for evidence.

Chapter 3 covers DNA analysis methods—historical, current, and newer specialized techniques—in some detail. Major topics are the isolation of DNA from biological evidence and its quantitation, RFLP (Southern blot), PCR, blot-dot typing systems (HLA-DQA1 and PM), D1S80, and STR typing by CE-fluorescent tagged primer detection. The information is detailed and sound. It would probably have been better to make clearer distinctions between older, no longer used, methods and those in current use. The authors also make a distinction between VNTR and STR loci, rather than treating STR as a subset of VNTR. Loci analyzed by RFLP and AMPFIP methods are termed “VNTR.” The STR typing section has a lot of information on PCR artifacts, thresholds, off ladder alleles, sequence microheterogeneity within loci, and so forth. The discussion provides readers with some appreciation of the complexities

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of interpreting STR profiles developed with these methods. It is noted that low copy number DNA profiling (a term people are now using to apply to situations in which the input template DNA is less than about 200 pg, some five-fold or more lower than optimal), may be investigatively useful, but is not ready for casework use. Most forensic DNA scientists would agree. Y chromosome typing is covered, and its value in sexual assault evidence mixtures described. There is also a brief discussion of SNPs, and the advantages and disadvantages of their use as polymorphisms in forensic evidence. Mitochondrial DNA typing is a major topic, and its value and its problems are described in some detail. The final section of the chapter discusses PCR problems, problems that can arise due to environmental insults, and various types of human error. Proficiency testing is mentioned as a QC-QA tool. One gets the impression that the authors favor blind proficiency testing without much appreciation of how much more complicated it is than open testing. The chapter concludes with a list of facts and assumptions that underlie DNA profiling—useful, because we don't regularly stop and think about them.

Chapter 4, the second of the two in-depth ones covering DNA typing as such, covers genetics, statistical treatments of data, and databases. Mendelian genetics is introduced, along with the basics of cell division and meiosis. Basic population genetics is covered, including HWE, linkage equilibrium, and the product rule. Example calculations are shown. The distinction is clearly made and illustrated between estimating probabilities of chance duplication among unrelated people with STRs, as against with mitotypes and Y-profiles. The concepts of probability of identity and discrimination power for genetic loci and profiling are introduced and defined. There is also some discussion of how mixture profiles can be handled. Parentage (paternity) calculations have also been included as a topic. There are several topics in the chapter that perhaps belong more to the previous chapter, including discussions of QA-QC, the standard-setting groups (TWGDAM, DAB, etc.), laboratory accreditation, examiner certification, etc. The last section of the chapter provides three DNA typing reports from forensic laboratories, and a commentary on what to look for in lab reports, how to interpret the statements in them, and what is and is not included. The RFLP example is the FBI Lab's report on the match between the stains on Monica Lewinski's dress and President Clinton. The HLA-DQA1/PM and STR report examples feature less spectacular cases. There are example paternity case reports as well, one of which shows an inclusion and the other of which shows an exclusion of the putative father. In the discussion of interpreting DNA reports, the authors favor "cannot be excluded" language in match cases versus something like "is included" or "matches." It is stated that "DNA is a science of exclusion not inclusion." Few scientists would agree. Science *per se* isn't either one. The authors may be trying to say that DNA evidence has primarily exclusionary value. That term is usually reserved for evidence that cannot be individualized—fibers and other trace materials, for example. Exclusions are absolute, whereas inclusions may either not be too probative, or there is no way to decide how probative they are. It seems unlikely that a full 13-locus DNA profile would be regarded as having primarily exclusionary value—in a match case with such a profile, most scientists think it's an identification for all practical purposes. On the other hand, some DNA profiles could be seen as having primarily exclusionary value—with systems or situations in which the probability of chance match is high enough to suggest that duplicates are a real possibility.

Chapters 5 through 7 feature legal topics, and will be of interest primarily to litigators, law students, and perhaps as background for expert witnesses. Chapter 5 begins with treatment of admissibility

law, and the journey from common law to *Frye* to *Daubert*, and the evolution of the judge as gatekeeper. Admissibility of various types and aspects of DNA evidence is discussed. Parentage testing is included. The legal process is described, and suggestions for case and trial preparation are enumerated. Included in this section are voir dire, jury selection, putting on witnesses, direct and cross examination, objections, and closing argument. Chapter 6 deals specifically with DNA evidence at trial. Presented from both prosecutorial and defense points of view, topics include planning case strategy, getting the DNA evidence in (or keeping it out), putting on and cross examining experts, and use of demonstrative evidence. Useful distinctions are made between getting the evidence in, getting a description of the DNA testing and profiling through an expert, and quotation of probabilities of chance duplication ("statistics") by experts. The treatment is detailed, and liberally illustrated with example Q and A testimony. Chapter 7 is about post-conviction appeals requesting DNA testing. There are, as we all now know, numerous examples of DNA exclusions of defendants convicted of serious offenses in cases where biological evidence remained available for testing. The current status of post-conviction DNA statutes is covered, and appendix E summarizes all the state statutes. Throughout these chapters, and in appendices B and E, numerous references and cases are cited. Appendix C is a summary of "innocence" projects in the various states that have them, with contact information. Appendix D is a summary of the statutes in New York, violation of which gets a person's profile into the SDIS. Appendix F is a list of things that might be requested under discovery. The legal aspects of DNA are familiar to me only as a scientist looking in, not as a lawyer. But based on my experience with lawyers and law students, these chapters appear to be very thorough and well done. They will also be of use in the training of expert witnesses.

The authors missed a few opportunities to critique bad terminology, and scientifically questionable practices, and to change out of date practices. Books are a better place to try and achieve these goals than journal articles, because books generally get wider play. I would like to have read that "DNA fingerprinting" is a bad term in spite of its persistent popularity with the media. The discussion of HWE testing in "Hispanic" populations provided the perfect opportunity to note that "Hispanic" in no way describes a genetically homogeneous population, and that the whole idea of "Hispanic" population data is a myth with utterly no basis in population genetics. And as noted earlier, there is no longer a good reason to have blood tubes in sexual assault evidence collection kits.

There are color plates of some figures, collected in a few sections of the book. In most cases, the color figures do add to the presentation.

As noted at the beginning, the book covers a lot of territory. The authors say that it is intended for attorneys, judges, students of science and law, and forensic scientists who are not DNA analysts. The material in Chapters 2–4 may be too detailed and complicated for most people without some biology/biochemistry background. It would provide a good "text" for a set of 4–6 lectures to upper division undergraduate forensic science students. The legal material will be very useful for lawyers, judges, and law students. Law students with no biology background could have their hands full trying to read the science chapters. And, the litigation chapter would be helpful in teaching DNA analysts how to be good expert witnesses.

Notwithstanding the quibbles, this book contains a great deal of useful information of value to all sorts of people involved in DNA analysis. It seems intended, and is likely to be a reference book. It should be quite useful to both science and law students, and practitioners, as a handy reference to scientific and legal aspects of forensic DNA typing.