

Comment: The Use of DNA Profiles in Forensic Contexts

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The article by Roeder raises *inter alia* the two significant issues in the forensic use of DNA profiles: (1) the reliability of the laboratory results showing a match between the DNA taken from the crime scene and the DNA of the accused and (2) the calculation of the probability that some one other person than the accused person might have been the source of the DNA from the crime scene. Unfortunately, having raised the issues, Roeder fails to come to grips with the real problems that these issues raise. I shall try, briefly, to clarify the situation.

LABORATORY RELIABILITY

Roeder devotes only three short paragraphs to the question of laboratory error and concludes by saying "I believe this emphasis on proficiency testing is misplaced" although no detailed argument is provided. The problem is that Roeder's description of the technique and her reference to paternity testing show that she has missed the essential technical issue. The usual scenario in a criminal trial is that a small amount of dried blood, semen or tissue scraping is recovered from the scene of a crime. A suspect is then identified, and a sample of his or her blood is taken in cubic-centimeter amounts. DNA from the crime scene scrapings and from the suspect's blood sample are then compared side by side in the same laboratory. (Sometimes the tissue or dried blood is found on property of the suspect and it is the victim's DNA that is to be matched with it.) While there is more than enough DNA recoverable from the suspect's large blood sample to carry out the needed procedures, the very small, and often degraded, sample from the crime scene does not contain sufficient DNA for the comparison. To obtain sufficient material, the DNA from the crime scene is "amplified," that is, copied thousands or millions of times in a procedure known as polymerase chain reaction (PCR). As the name of the procedure suggests, the

original small number of DNA molecules are copied once, then these copies plus the original are copied a second time and so on for a number of cycles, increasing the total population of molecules exponentially until a sufficient amount has been produced for the matching procedure. The problem with the PCR technique is that because of its chain nature, contaminant molecules in the original sample may also be amplified and, since the original crime scene sample contained so few molecules, contaminants may overwhelm the original in the amplification. In addition, small differences in DNA sequence can have very large effects on the relative amplification of the components in an original mixture.

Now consider the actual practice in a forensic DNA laboratory. A technician is handling two samples. One is the very large DNA sample from the suspect's blood, the other is the minuscule DNA sample from the crime scene, which is then amplified by PCR. The situation is ideal for PCR contamination, with the result that the suspect's DNA will not really be compared with that from the crime scene, but with his or her own DNA that has just been replicated in the PCR reaction. The result will be a perfect match.

All of us who use the PCR technique regularly are acutely conscious of the contamination problem, and the best laboratories have suffered occasionally from it. The perspiration and "oils" on fingertips have provided enough DNA contamination in PCR experiments to give completely artefactual results. Only careful replication catches these errors, and some errors have not been caught until much later when another laboratory found conflicting results. In the forensic context, where the liberty and even life of the suspect is in question, it is essential that courts be assured that laboratories are taking careful precautions against these contamination errors, not to speak of grosser errors of recording etc. Representatives of commercial laboratories that have previously been found to provide erroneous results have told interviewers that they have "cleaned up their act." Perhaps they have, but we cannot know without independent checks, and anyway what about the people convicted before they "cleaned up their act"? The FBI has consistently refused to allow indepen-

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