The honest scientist's guide to DNA evidence

Dear Bruce,

Thank you for your invitation to participate in the DNA symposium. As you know DNA has never been a prime research focus of mine, and I have been so preoccupied with my own work on ITPT (intertemporal personal transportation) that I thought I must decline. Happily, however, the two projects came together, for I recently had an amazing breakthrough during which by coincidence I stumbled across a book entitled *A Century of DNA Testing* and holocopied (a fancy form of Xeroxing) the following few pages for you.

Even by 1996, before the second NRC Report, which fostered the switch to Bayesian methods, appeared and several years before the general abandonment of RFLP procedures, the statistical issues that had so roiled the early days of DNA testing had largely been resolved. This occurred not because the statistical and genetic disputes we describe above had all been resolved, but rather because the need to confirm identifications from burgeoning data bases stimulated several different innovations that increased the informativeness of the RFLP approach to DNA testing, thus reducing the chances of coincidental matches to minuscule proportions even when the suspect population included relatives or had the same narrow ethnic heritage. In one Minnesota case, for example, the state crime lab simply tested alleles at nine loci. But Minnesota at the time was laboring under a short-sighted (and soon overturned) court ruling which precluded attaching statistical probabilities to DNA matches, and thus, without resorting to statistics, the lab's scientists had to be able to testify that an identification was virtually certain.

Nevertheless, problems stemming from what Professor Junipurr, some fifty years ago, in his study of forensic laboratories called the 'infallibility complex' continued to appear. Some of the most important of these problems and ways that were suggested at the time for meeting them are captured in the following extracts from the original edition (Jack Point, ed., 1996) of the still essential handbook, *The Honest Scientist's Guide to DNA Evidence*. We can in this history do no better than reproduce the relevant portions, leaving the original spelling and grammar, including archaic gendered pronouns, untouched. The somewhat preachy nature of the original handbook was, we believe, influenced by the religious fundamentalism resurgent at that period. Also, though it may not be evident to readers today, many of the Handbook's suggestions were regarded at the time as quite Utopian.

Section 7.1: (Subjectivity)

The honest scientist recognizes that she herself is a test instrument, and a fallible one at that. Subjectivity inescapably enters into any human endeavor, and should not be denied. DNA testing is rife with subjective elements, no place more so than at the crucial stage of deciding whether a match exists. On the one hand, non-matching extraneous bands may sometimes be properly disregarded and patterns that do not quite meet objective matching criteria may be appropriately regarded as incriminatory matches. On the other hand, band patterns that do meet objective matching criteria may be treated as exonerative depending on how they deviate from perfect matches. The DNA expert should not hide behind the cloak of science to deny the role of human judgement. White coats should not be worn into the courtroom either literally or figuratively.
At the same time, the honest scientist tries to be as objective as possible in her judgements. She realizes that this is inconsistent with a strong a priori belief that the donor of a suspect sample is guilty. Thus she avoids any information suggesting the involvement or involvement of the accused until after she has prepared her report and, in the ideal case, until after she has testified. Laboratories should cooperate to make this easy. Crime-related information should be stripped from all information sent to the analyst unless it is essential to the test and its interpretation (e.g. information that several people are suspected of participating in a rape or that the suspected rapist is the victim’s brother).

Scrupulous laboratories should also realize that being continually identified with a side may also bias judgements. Thus, they should seek out business from defense attorneys who seek to exonerate clients and encourage their scientists to take the rare opportunities that come along to testify on behalf of defendants.

An additional and highly recommended way of coping with subjectivity is to transform DNA tests from true-false into multiple-choice tests by routinely providing scientists with three test samples. One or two of these, varying on some random schedule, should be the suspect’s and the other(s) should come from one or two non-suspects. This marginally increases the cost of DNA tests, but we are dealing with decisions that can take human lives. Moreover, multiple testing carries the added benefit of providing laboratory-specific proficiency information.

Section 9.3: (Proficiency Testing—continued)

The honest scientist works for the Virtuous laboratory. The Virtuous laboratory maintains a rigorous system of proficiency testing, both to identify and correct sources of error and as an incentive for continual high quality staff work. Four types of samples may be analyzed as part of a proficiency testing program: known samples, unknown samples of pure quality, unknown samples of case quality, and apparent case samples. While these different types of samples all have a role to play in measuring and maintaining laboratory proficiency, only the last, test samples regarded by both the laboratory and analyst as true casework samples, provides a true picture of the quality of laboratory procedures, for only apparent case samples are certain to be treated by laboratories as if they were casework samples. Conversely, if a laboratory knows that any apparent case sample it analyzes may be a test, the incentive is to treat each sample submitted for analysis as if it were a test sample, and the quality of all the laboratory’s work should increase.

It is, even today, difficult to generate convincing casework test samples, for such samples must appear to have come from specific police departments or prosecutors’ offices, and any communications with the police or prosecutor’s office during the course of analysis must be consistent with the otherwise apparent genuineness of the sample. For this reason, laboratories, police and prosecutors should agree to join the proposed APTLAB (Accredited Proficiency Tested Laboratory Analysis Bureau) organization. As proposed APTLAB would serve as an intermediary between parties seeking DNA tests and laboratories that do them. APTLAB would receive all DNA test samples from police departments or other agencies and after removing unnecessary case-related information that might accompany samples (see Section 7.1) would forward the material to the laboratory that the agency chose to conduct the test. Approximately one out of every eight samples forwarded to a laboratory, on some random schedule, would be a casework test sample. Although the problem of false positive matches has been the target of most concern, APTLAB, according to the proposal, would forward as many matching test samples as non-matching ones. Missing matches also reveals weaknesses or biases in laboratory procedures, and the error of mistakenly freeing an actual rapist or murderer may be as socially harmful as mistakenly convicting an innocent person. Only after test results were communicated to APTLAB would the testing laboratory receive the name of the submitting agency. Thereafter all communications would be between the laboratory and the agency. Statistics on error rates, aggregated across laboratories using similar procedures and also by laboratories, would be made freely available.

At the moment it does not appear that APTLAB will get off the ground, for the suggestion has met with fierce resistance from forensic scientists and laboratory directors. Three arguments are made against it. Least is made of the first argument, but we suspect it is the strongest of the stated motivations behind the heated objections. This is that APTLAB will interfere with the relations that many laboratories and forensic scientists have with the agencies and individuals that submit samples to them. While this is true, the honest scientist