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EDITORIAL

Forensic Science: Taking Giant Steps Forward

Moses Schanfield

Monroe County Public Safety Laboratory, Rochester, NY, USA

Forensic science has always been an applied science. In the 1930s, the ABO blood groups were first applied to forensic testing in the United States. When new serological markers were found in the 1950's and 1960's, they were added to the forensic tool kit. The introduction of electrophoresis increased the ability to individualize bloodstains but did little to improve the individualization of semen stains. The beginning of the revolution in the individualization of sexual assault evidence came with the introduction of DNA technology. DNA technology offered the opportunity to separate male from female components in sexual assault cases. This had been the curse of analyzing sexual assault evidence with non-DNA inherited traits, which is the limited usefulness of these genetic markers. For the first time it was not necessary to try to interpret mixtures. In 1985, Alec Jeffreys (1) used DNA to solve the vicious sexual assault murder of two young women, with an interesting note that the first suspect in the case was exonerated. In the United States, the year 1986 was the watershed year. In that year, the first sexual assault case in which restriction fragment length polymorphisms (RFLP) was used went to trial in Florida (State of Florida vs Tommy Lee Andrews). At the other end of the United States, in California, polymerase chain reaction (PCR) was being used for the first time to identify a skull of a child found in the desert, as there was not enough DNA for RFLP testing. The age of forensic DNA testing had dawned. Between 1985 and 1995, RFLP testing reigned. However, even while RFLP was the king, its replacement was already in the wings.

It is interesting to note that in 1986, DNA technology was a technology of last resort, used to save cases that had failed with non-DNA marker testing. The initial success rates were low. By the late 1980's and early 1990's, PCR based testing was being used to test samples from which RFLP testing could not provide results. By the mid 1990's, the handwriting was on the wall – RFLP would be replaced by PCR-based length polymorphism testing. These short tandem repeats (STRs), the smaller siblings of the larger amplified fragment length polymorphisms (AFLPs) described in 1989, were the answer to the quest for highly informative DNA markers generated by PCR-based testing.

By 1997, forensic science in the west was moving toward this standard with automated equipment and emergent multiplex technology at break neck speed. At the American Academy of Forensic Science meeting in February of that year, Dr Dragan Primorac, a colleague with whom I had worked in Croatia to help develop PCR testing for the identification of Balkan War remains, and I discussed the possibility of introducing this technology to scientists from the emerging Eastern Block countries. At that time it was decided to see if we could put on an intensive training course in PCR-based testing for forensic and clinical scientists. It was an inconceivable idea to put on a meeting in less than eight months. However, in September 1997, the First European-American Intensive Course in Forensic and Clinical PCR Testing was conducted in Split, Croatia (2). It was an enormous success for the Croatian organizers and largely American faculty. More than 130 participants from over 30 countries spent two weeks working and studying together.

In the fall of 2001, the Second European-American Intensive Course in PCR-based testing will occur. This time there has been greater planning and lead-time. The meeting will be bigger and the atmosphere changed. The former fledgling forensic and clinical scientists have taken the technology learned at the first meeting and have made it their own. Their needs now require advanced state-of-the-art training. The papers presented in this special issue of the *Croatian Medical Journal* reflect where we have come since 1997. The 25 papers reflect the changes in the technology and skill level of the participants, as well as continuing areas of concern. The spectrum of the papers is quite varied.

There are still concerns about the collection and preservation of evidence (Lee and Ladd, p. 225), and the interpretation of mixed samples is still subject to study (Ladd et al, p. 244). The array of types of markers is expanded STR multiplexes (a few loci co-amplified [3-9]) have become "megaplexes" ([15-16 loci], Tomsey et al, p. 239; Alonso et al, p. 260). Mitochondrial DNA, once the realm of a few specialized laboratories, is reaching out (Miller and Budowle, p. 315; Gabriel et al, p. 328; Melton and Nelson, p. 298; Parsons and Coble, p. 304). Genetic variation on the Y

chromosome, originally studied as a specialty, is becoming a common and a useful adjunct marker system (Henke et al, p. 292; Parson et al, p. 285; Prinz and Sansone, p. 288; Kersting et al, 310). Mundane issues that had not been previously thought of have become major logistic problems, such as the setting up of large DNA data banks (Ban, p. 256; Steinlechner and Parson, p. 252), or a forensic PCR laboratory (Crouse, p. 247). The article on identifying the donors of low copy number (trace amounts) of DNA (Gill, p. 229) is certainly pushing the envelope and adds a new dimension, and the development of new DNA quantitation systems (Mandrekar et al, p. 336) adds to the battery of tools needed to work. Miller et al discuss the use of non-human DNA in forensics. At the other end of the spectra are papers on the mathematical treatment of multilocus genotypes and parentage analysis (Tracey, p. 233), and the legal issues of admission of the new technology (Pitluck, p. 221). Finally, there are papers, some of which were previously listed, that deal with the *reason d'etre* of the project, the identification of missing individuals, both in the former Yugoslavia and elsewhere (Alonso et al, p. 260; Huffine et al, p. 271; Lorente et al, p. 267).

Disclaimer

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1 Jeffreys AJ, Wilson V, Thein SL. Hypervariable "minisatellite" regions in human DNA. Biotechnology 1992;24:467-72.

2 Gardiner G. The First European-American Intensive Course in PCR-Based Clinical and Forensic Genetics. Gene Letter 1998:2:(2).

Correspondence to:

Moses S. Schanfield

Monroe County Public Safety Laboratory

150 South Plymouth Avenue, Room 524

Rochester, NY 14614, USA

mschanfield@netscape.net