A Review of the Cases Submitted for DNA Analysis in the FBI Laboratory

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INTRODUCTION

The DNA Analysis Unit (DNAU) of the FBI Laboratory began accepting criminal cases for DNA analyses in December, 1988, and as of October, 1989, has accepted approximately 1,000 cases. The implementation of the restriction fragment length polymorphism (RFLP) protocol was the result of approximately three years of research at the FBI Laboratory Forensic Research and Training Center (FSRTC), Quantico, Virginia.

The RFLP protocol developed by the FBI Laboratory has been described in the literature (Baechtel, 1988, Budowle, 1988, Budowle et al. 1988). One of the most important determinations of the RFLP protocol development was that the DNA profile results were reliable, accurate and reproducible. The validation of the protocol currently used by the FBI Laboratory included studies involving outdoor daylight and dark exposure studies, time, temperature and substrate studies, chemical, biological and bacterial mixture studies, nonhuman cross-reactivity studies, and evidentiary stains from adjudicated criminal cases. The validation studies resulted in either accurate and reproducible profiles or no profiles at all. No false positives were obtained (Adams, 1988). Equally important, quality control (QC) and quality assurance (QA) programs were adopted within the DNAU to monitor the entire RFLP protocol and the interpretation of results (Mudd and Presley, 1988, Monson, 1988).

The most important quality control measure used in the DNA profiling protocol is the human DNA cell line. This internal control is treated in the same manner as known and questioned stains and serves to monitor the extraction, digestion, electrophoretic separation and ultimately the interpretation of the final autoradiographic results. Other quality control measures used by the DNAU have been set forth in the protocol.

Quality assurance is regularly monitored in the DNAU by two kinds of proficiency tests. The first is an open proficiency in which samples are prepared by the FSRTC and submitted for analysis. These samples are known to the examiners as proficiency samples. The second kind of proficiency test is designated as a blind test. These samples, also prepared by FSRTC, are submitted by a cooperating law enforcement agency and simulate an actual case. The extent to which the blind sample cases are submitted is unknown to DNAU examiners.

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Edited by H. F. Polesky and W. R. Mayr

Concurrent with implementation, the DNAU of the FBI Laboratory adopted a case acceptance policy which limits the examination of evidence to violent crimes with known suspects. DNA analysis is performed on probative evidence submitted by state or local crime laboratories lacking DNA typing capabilities following serological testing. Cases accepted without prior serological analysis are first processed in the Serology Unit of the FBI Laboratory for the identification of semen and/or human blood and blood grouping.

In the first ten months of operation, there have been approximately 1,000 cases accepted for examination by the DNAU. These cases represent submissions from Federal (approx. 10 percent), state (approx. 87 percent) law enforcement agencies and U.S. territories and possessions (approx. 3 percent). DNA analysis has been requested from nearly all 50 states.

A REVIEW OF THE FIRST 200 COMPLETED CASES SUBMITTED TO THE DNAU

Of the first 100 cases received in the DNAU, 71 percent were rapes, 27 percent homicides and the remaining 2 percent consisted of other violent crimes. Subsequent analyses of later 100 case groupings yielded nearly identical percentages. Serial rapes accounted for 16 of the first 71 rape cases. An examination of the RFLP results for the first 100 cases determined that 87 cases yielded successful DNA profile results. A successful result was defined as at least one probe result from a probative questioned body fluid stain which was compared to a known blood sample in a particular case. The remaining 13 cases yielded degraded or insufficient DNA. It is further noted that nearly all the first case samples were less than one year old and this likely contributed to the relatively high rate of successful DNA profile results. The variable number tandem repeat sequences recognized by the probes utilized in the DNAU exhibit a degree of polymorphism that approaches individualization of a sample which requires analysis with at least three or four probes (Budowle, 1988). The DNAU obtained results from four probings in 64 of the first 100 cases. For the second subsequent 100 case grouping, the addition of a more sensitive probe increased the overall number of four probe results to over 80 out of the second 100 cases. Our results suggest that a successful initial probing is likely to be followed by additional successful probings. For the first 100 cases, three successful probings were obtained in 14 cases, 2 probings in 8 cases and only 1 case yielded a single probe result.

One of the most significant contributions of DNA analysis to law enforcement is the ability to distinguish contributors of a mixed body fluid stain when compared to known blood samples. The differential DNA extraction procedure adopted by the FBI (Baechtel, 1988) allows for the separation of the male and female DNA components in mixed body fluid stains such as semen found on vaginal swabs. Of the first 71 rape cases submitted for DNA analysis, DNA profiles from 76 percent matched the suspects while 24 percent showed that the suspect was not the contributor to the male DNA profile. In most of these cases, conventional serological analyses did not eliminate the suspect as a possible source of the semen due to the inherent interpretational difficulties of body fluid mixtures.

CONCLUSIONS

DNA profiling does provide an excellent technique for potentially individualizing forensic biological stains in criminal cases. DNA profiling can provide a clear and definite connection between a suspect and victim in many cases, and DNA profiling in some cases has also been used to eliminate a suspected individual. DNA profiling utilized within proper quality control and assurance guidelines and based on a scientifically sound and valid protocol provides a powerful tool for the forensic laboratory and the criminal justice system.

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