

100 MOMENTS

DEOXYRIBONUCLEIC ACID

By Mike Peterson (1970-2010)

The changes in the crime laboratory's capabilities, technologies, and methods during my employ (1972-2010) were mind boggling. Virtually every laboratory specialty area was affected in some way. The case may be made that the "Micro-Analysis" section experienced the greatest changes, ultimately abandoning almost all of what it traditionally had done and being swallowed up by its children, DNA and PCO.

Prior to DNA, the Micro-Analysis section of the laboratory performed the identification and characterization of crime scene stains as well as the comparison of hairs, and identification of fibers. In the early 70s the analysis of biological stains was limited to the identification of blood or saliva or semen. Characterization of those stains was limited to determining the species of origin (human or other animal) and, if human, typing in the ABO blood grouping system. The determination of the ABO blood group of the donor of a non-blood fluid was also frequently possible. The laboratory had 3 analysts assigned to that work.

The next 20 or so years were spent improving the discrimination potential of blood and semen stains. Additional blood grouping systems were evaluated, developed and applied as well as several polymorphic protein and enzyme systems. All was going well and we were slowly improving our discrimination by adding additional typing systems and additional staff.

In the mid-80s there were 2 homicides in England, separated by 3 years. A new analysis method utilizing DNA had been applied demonstrating that it was most likely the same individual was involved in both deaths. That was followed by the mass analysis of blood samples of over 4,000 individuals. This would have been a nearly insurmountable task using current laboratory methods. The gauntlet had been laid and the FBI laboratory, as well as other crime laboratories, were challenged to develop DNA analysis methods and train crime lab personnel nationwide in standardized analysis methods.

The DCI laboratory provided 2 individuals for FBI training in 1989. They were trained in the current (at the time) method known as

restriction fragment length polymorphism (RFLP). It was certainly a powerful analysis method but lacked sensitivity and required DNA samples that were not significantly degraded.

Even during RFLP training, there were rumors of a different technology under development. This technology used a process called the Polymerase Chain Reaction (PCR). PCR addressed some of the RFLP shortcomings by

- 1) Targeting a “short section of DNA” (more likely to survive degradation) and
- 2) Amplifying (copying) that short section many times (improving sensitivity).

The laboratory chose to reject implementation of RFLP and await the development of PCR.

Casework analysis using PCR was begun in the late '90s with the introduction of a commercial DNA typing kit targeting a DNA site known as DQ alpha. Additional DNA typing systems were added as they became available, ultimately leading to the analysis of 10 DNA systems in routine work.

Concurrent with the expansion of DNA testing systems came the realization that a searchable DNA database could be developed. However, for such a database to be useful on anything more than a local level, some standards for DNA profile integrity and uniqueness needed to be established. The discrimination provided by the 10 DNA systems currently in use was not adequate for a large database. Under the authority of the FBI, thirteen (13) “core” short tandem repeat (STR) loci were identified as being essential to a DNA profile, and would be

the foundation for the development of a Combined DNA Index System (CODIS). That number has now increased to 20, adding loci to minimize the chances of a co-incidental match in the database and to be consistent with international databases.

Iowa legislation authorizing the creation of the state DNA database was passed. Initially, any person convicted of a felony was required to provide a sample for the database. This has since been expanded to include some misdemeanor convictions as well. The development and maintenance of this database was assigned to the DPS. This “new” function required the development of an additional “unit” within the laboratory called PCO (profiling convicted offenders). There are currently in excess of 130,000 searchable DNA profiles in the state database.

It has become routine practice for a DNA profile developed from casework samples to be searched against the state database. Nearly every county in Iowa has submitted at least one case to the laboratory which has resulted in a match to an entry in the DNA database. This has enabled the DNA unit to provide the investigators with the name of a potential donor of a forensic sample, a feat previously limited to the fingerprint section.