DNA Analysis: A Powerful Investigative Tool

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INTRODUCTION

DNA analysis has been said to be the most powerful investigative tool since the advent of fingerprint analysis. Unfortunately, as the demand for DNA analysis increases, more crime laboratories are relegated to performing DNA analysis just prior to the trial after the bulk of the investigation is complete. The following cases were chosen to demonstrate several ways in which DNA analysis can be used in the initial stages of an investigation.

CASE ONE

In the summer of 1998 in a small suburb of Indianapolis, Indiana, an elderly woman who had fallen asleep on her couch was awakened in the early morning by an intruder who had broken in through the back door. The man proceeded to brutally beat and sexually assault the woman.

That same morning in the same small suburb, a man was found passed out in his front yard having apparently overindulged in alcoholic beverages. The man's clothing was stained with blood, (see Figure 1) and there were scratches on his forearms. Believing this was more than mere coincidence, he was immediately tagged by local authorities as a likely suspect. The investigators were seeking evidence to quickly justify an arrest warrant because the suspect could only be held in jail a short time for public intoxication.

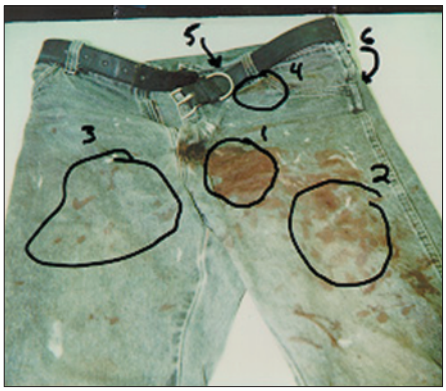

Figure 1. Photograph of the initial suspect's heavily bloodstained pants from Case One.

The evidence, a victim sexual assault kit, the suspect's clothing and the suspect's blood standard, was submitted for analysis later that same morning. DNA analysis was performed on the semen found on the vaginal/cervical swabs collected from the victim and the blood on the suspect's shirt and pants using the *GenePrint*® PowerPlex™ 1.1 System and visualized using the Hitachi FMBIO® II Fluorescence Imaging System. Because PCR-based analysis was utilized, the results were available by the following evening. However, the suspect was excluded as a possible contributor of the seminal material found on the vaginal/cervical swab, and the blood on the suspect's shirt and pants was not consistent with that of the victim (see Figures 2 and 3). As it turns out, the suspect was involved in a domestic quarrel, which resulted in the bloodstained clothing.

The next step in the investigation also involved DNA analysis. The investigators gathered a list of approximately 15 men who lived in the surrounding area and were known to have their profiles entered into the State's offender DNA database. Using the Combined DNA Index System (CODIS) software, the profile obtained from the semen on the vaginal/cervical swab was searched against the offender database. No matches were found; therefore, this latest list of potential suspects was excluded.

In the following weeks, the investigators collected oral swabs from approximately 25 other individuals. These men were either seen in the area of the crime or matched the description of the perpetrator. Each of the men was subsequently excluded through DNA analysis.

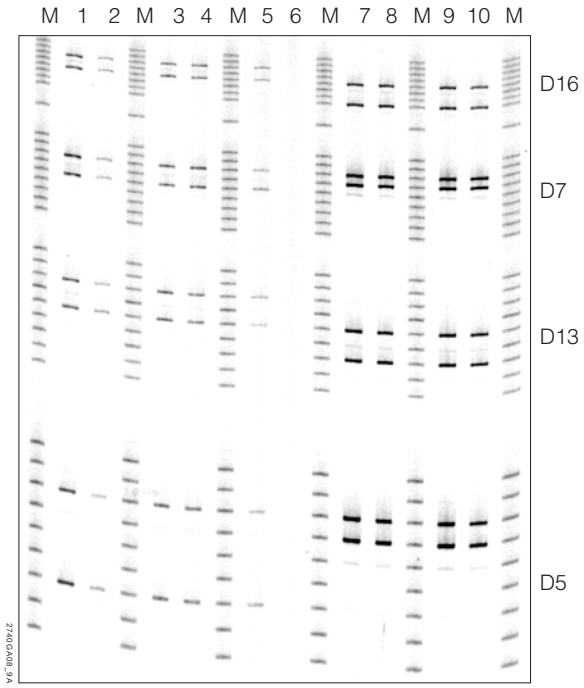

Figure 2. GammaSTR™ loci (STR loci D16S539, D7S820, D13S317, D5S818) of the *GenePrint*® PowerPlex™ 1.1 System. Lanes 1–5: Samples from sperm cell fraction of the vaginal/cervical swabs and vaginal wash collected from the initial victim. Lane 6: Sperm cell fraction reagent blank. Lanes 7–10: Samples from non-sperm cell fractions of the vaginal/cervical swabs.

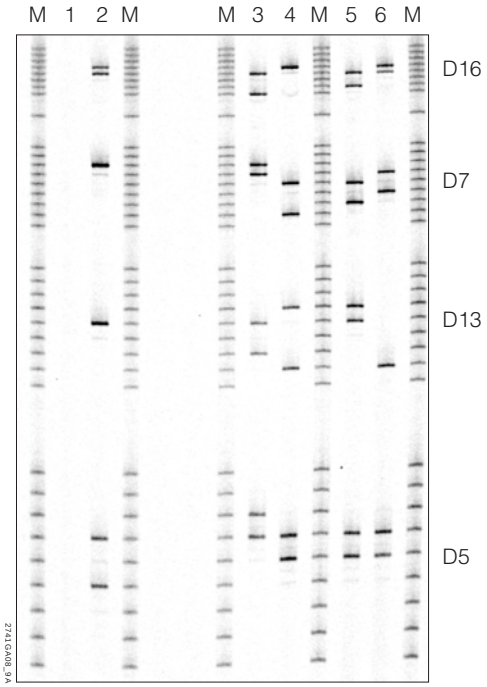

Figure 3. GammaSTR™ loci (STR loci D16S539, D7S820, D13S317, D5S818) of the *GenePrint*® PowerPlex™ 1.1 System. Lanes 1 and 2: Samples from cuttings of the suspect's pants. Lane 3: Victim's blood standard. Lane 4: Sample of suspect's standard. Lanes 5 and 6: Positive control samples.

CASE TWO

Almost 3 months to the day after the first attack, a second, similar assault occurred in another small suburb roughly 25 miles away. Once again, an elderly woman was awakened early in the morning to find an intruder beside her. The woman was beaten and choked until unconscious and then possibly sexually assaulted. Due to the similarities between the two cases, it was initially thought that they were connected.

A man staying in a neighboring house was immediately developed as a suspect. DNA analysis was performed on a cigarette butt found at the scene and on bloodstains on a pillowcase found outside the residence where the suspect was visiting. The profile obtained from the cigarette butt was consistent with the suspect, and the profile obtained from the pillowcase was consistent with the victim. However, a comparison of the profile obtained from the cigarette butt to the profile obtained from the semen in the first assault demonstrated that the two assaults were performed by separate individuals.

SUMMARY

The two cases described demonstrate several ways DNA analysis can be used as an investigative tool, not only to link an individual to a crime but also to exclude an individual. In the first case, a seemingly good suspect was developed early in the investigation. Through DNA analysis, though, he was excluded before an excessive amount of investigative time had been wasted. In addition, within hours of completing the DNA analysis, many other potential suspects were eliminated with little to no waste of investigative time by utilizing the offender DNA database, in conjunction with CODIS software. Subsequent suspects were excluded through DNA analysis of oral swabs, which are easily collected. A sad note to the first case is that the victim has since died of natural causes. Therefore, a visual identification of the perpetrator is now not possible, and the best remaining evidence lies in the DNA analysis.

In the second case, a suspect was linked to a crime scene, and a victim was linked to a suspect. This, along with other circumstantial evidence, has led to the arrest of the individual. Furthermore, the individual was excluded as being the perpetrator of the first assault within minutes of having completed the DNA analysis, saving both police agencies time and effort. Unfortunately, that means the attacker from the first case is still at large.