Guns and the DNA Left Behind

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Gun violence has become a major problem in many cities. An increase in the nation’s gang activity has been one of the primary sources feeding this pandemic. According to the National Crime Victimization Survey, the rate of firearm violence increased between 2004 and 2005, from 1.4 to 2.0 victimizations per 1,000 persons age 12 or older.1 Identifying the persons holding these weapons and using them in the commission of violent crime has been challenging. The guns are trafficked into the country and sold on the street, and it has been very difficult to tie these weapons to the end user. As the forensic community continues to gain momentum with the development of new and expanded techniques for DNA identification, this task may begin to get easier.

It is widely known that deoxyribonucleic acid (DNA) is the substance found in virtually every cell in an individual’s body and has been called the “genetic blueprint.” Each person’s DNA is unique (except for an identical twin) and is constant throughout the body. DNA can be transferred through many routes. Blood can be left behind after a stabbing or saliva containing sloughed off epithelial cells from the mouth can be transferred to a cigarette butt. Recently, results have been obtained from DNA analysis of handled objects containing minute quantities of cellular material containing DNA.

When forensic DNA analysis began in the mid-1980s in the U.K. and U.S. with the restriction fragment length polymorphism (RFLP) methods, the amount of blood required to even have a hope of getting a result was a stain the size of a dime or quarter. Within several years, the early Polymerase Chain Reaction (PCR)-base methods such as DQA1, Polymarker and D1S80 were being implemented in a few labs around the country. These markers did not have the same discriminatory power as the RFLP methods—one in 100,000 as compared to one in the billions—but the sensitivity was dramatically increased. Using the PCR-based methods, bloodstains that were barely visible could be analyzed. The equivalent of DNA from approximately 50 to 100 cells could produce results. Eventually new genetic markers, short tandem repeats (STRs), were developed for use with the PCR-based technologies that could provide a similar discriminatory power to that of the RFLP markers. Now most crime laboratories across the country analyze, at a minimum, a core set of 13 STR loci (CODIS loci). For several years, the sensitivity of these methods remained at 50-100 cells, not unintentionally.

In the mid- to late-1990s several papers were published in the scientific community that described DNA results obtained from very low levels of a substance containing DNA.2 For example, one paper reported obtaining results from latent fingerprints.3 The momentum for this analysis has steadily grown in several countries, including recently in the U.S. Scientists in the U.K. have published many papers on the care that should be taken when conducting DNA analysis on low quantities of DNA, also known as Low Copy Number (LCN) analysis.4 Several methods have been developed that allow the analyst to potentially obtain DNA typing results from the equivalent of less than 10-20 cells.

While this may not seem to be a significant difference from the previous sensitivity, it has crossed a crucial threshold. The ability to obtain results from less than 20 cells now means, for example, that a latent fingerprint that may not be sufficient for print comparison purposes may provide enough DNA for analysis. At this point, most DNA typing results using LCN methods are to be used for investigative purposes only as the general acceptance of the methods grows in the forensic community. It should be noted that although this development has been increasingly utilized in the U.K. to assist with solving crime, it is still in its research and development stage in the U.S. and should be carefully considered before being relied upon as a primary investigatory tool at this time.

Further, it is not always necessary to use the somewhat extreme LCN methods to obtain DNA typing results from handled objects. DNA analysis have...
been swabbing or taking cuttings of clothing for years in an attempt to determine the wearer of the clothing left behind at a crime scene. Under duress in a stressful situation, such as the commission of a crime or through the handling of an object over an extended period of time, epithelial cells can be deposited on an object through the normal transfer of sweat and body oil. As described above, the conventional DNA analysis methods have the sensitivity to produce DNA results from limited material as well. These methods have been generally accepted in the criminal justice system for years and are no more controversial than the standard analysis of a bloodstain.

Firearms are objects that have several surfaces that are potentially good places for sloughed off epithelial cells-containing sweat and body oil to accumulate. The grips and hammer are usually textured which makes them difficult to examine for latent prints but actually aid in the accumulation of DNA. The slide grip area of a semi-automatic pistol is typically grooved, again a good place for DNA to accumulate. The trigger itself may be too small an area to retrieve a usable latent print but may contain sufficient DNA for analysis.

As in any result from DNA analysis, the meaning of the finding can be complicated. There are several caveats that go along with DNA analysis of handled objects. First, not all people who handle an object will leave a sufficient quantity of DNA behind for analysis. The success rate for analysis of handled objects varies greatly and is affected by many known and unknown variables. Second, anyone who has touched the object is a potential DNA donor to the object. DNA analysis cannot determine the length of time the biological material has been on the item nor definitively determine the order in which multiple individuals may have handled an object. The DNA results cannot determine if the DNA was deposited before, after, or during the commission of a crime. Further complications arise if individuals in the chain of custody have handled the gun without gloves. In the end, if an individual’s DNA is found on an object, it only means that the individual came in contact with the object at some point in time. If an individual’s DNA is not found on an object, it does not necessarily mean that the person has never handled the item.

To summarize, DNA analysis is another tool that can be used as an aid in the identification of persons who have handled a weapon. As with all scientific evidence, the meaning of the results must be evaluated in the context of their limitations.

1 Catalano, Shannan, Criminal Victimization, 2005, BUREAU OF JUSTICE STATISTICS BULLETIN (U.S. Department of Justice, Office of Justice Programs), September 2006, NG 214644.

2 See generally Taberlet, Peter et al, Reliable Genotyping of Samples With Very Low DNA Quantities Using PCR, 24(16) NUCLEAR ACIDS RES. Aug. 15 1996, at 3189-94; see also Findlay, I. et al., DNA Fingerprinting from single cells, NATURE, Oct. 9, 1997, at 6555-56; see also Renterghem, P.V. et al., Use of Latent Fingerprints as a Source of DNA for Genetic Identification, PROGRESS IN FORENSIC GENETICS 8, 501-503 (Elsevier Science, 2000).


For more detailed information, please see Silent Witness—Volume 10, Number 3 online at: http://www.ndaa-apri.org/apri/programs/dna/newsletter.html

U.S. Court of Appeals Strikes Down DC’s Gun Law

In a recent 2-1 decision, the United States Court of Appeals for the D.C. Circuit struck down D.C.’s gun control ordinance, which prohibited newly registered handguns; prohibited carrying a gun within one’s residence; and required licensed firearms to be kept locked or disassembled. After a lengthy discussion of different possible interpretations of the Second Amendment, the Court determined that the Second Amendment protects an individual right to keep and bear arms, which is not limited to militia service. The Court held that the D.C. ordinance amounted to a complete prohibition on the lawful use of handguns for self-defense, and as such held it to be unconstitutional.