



### A20 Collection of DNA From Spent Shotgun Shells

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After attending this presentation, attendees will gain a better understanding of obtaining DNA profiles from spent 12-gauge shotgun shells. Attendees will also be educated about the effect of the shooter's gender, the type of shell, and the order in which the shells were loaded on the completeness of the DNA profile obtained.

This presentation will impact the forensic science community by demonstrating that genetic profiles can be obtained from spent shotgun shells.

According to the FBI in 2005, shotgun crimes accounted for five percent of homicides by firearms. This is second only to homicides by

handguns.<sup>1</sup> Typically when investigators arrive at the scene of the crime, the only evidence related to the gun is a spent shell casing. When the shells are handled and loaded into the shotgun, DNA is transferred through the loss of epithelial cells. It has been shown previously that touch DNA can yield DNA profiles from spent bullet casings from a handgun. However, fewer epithelial cells may be shed during the handling of shotgun shells because less pressure is required to load the shotgun. It is hypothesized that profiles can also be obtained from spent shotgun shell casings.

Previously, it was believed that the difficulty of obtaining DNA profiles from fired cartridge cases was due to the high temperatures to which the cartridge is subjected in the gun barrel. Moreover, the small amount of DNA deposited through handling of the cartridge was thought to be negligible. This is analogous to the conditions of a shotgun.

Subjects involved in the present study were asked to load a 12-gauge shotgun with three shotgun shells. After loading, each subject fired the shotgun. The shells were collected post ejection by retrieving them with sterilized wooden sticks and placed in a bag, which was assigned a random number. The bags were color coded according to the order the shotgun shells were shot by an individual not involved in the study, creating a blind study. Reference buccal swabs were collected and assigned the same number associated with the shooter's ejected shells. This allowed the research subjects to never be directly linked to their identification number.

The experimental design involved twenty study subjects, ten males and ten females. The ratio of males and females was chosen to test the effect of gender on the completeness of the genetic profile obtained. Past studies with extremely small sample sizes have suggested that there may be sexual dimorphism in shedding behavior, with males being higher shedders. This study will contribute to the other studies and a meta-analysis of all the studies. The subjects fired both high brass and low brass shotgun shells to study the effect of the type of shell on the results. High brass shotgun shells were originally created to be able to hold more powerful ammunition. The appearance of these two types of shells differs in that the brass on low brass shells only extends about half an inch up the plastic. The high brass shells have more exposed brass. The loading order of the shells was also analyzed in order to observe if there was any effect on the data.

DNA from the casings was transferred using a double-swab technique with 20% SDS as the surfactant. An organic extraction was then performed on the DNA swabs. Multiplex PCR was performed on the samples using the AW12106 miniplex developed at Duquesne University. This miniplex utilizes five loci: D8S1179, D16S539, D5S818, TPOX, and amelogenin. The miniplex was specially designed for DNA segments less than 200 base pairs. This is useful for extremely degraded DNA samples. The samples were then genotyped using a genetic analyzer and compared to the reference samples collected. A partial profile was considered to be amplification of one to four loci. The completeness of the genetic profiles obtained was examined in connection with the variables previously stated.

#### References:

- 1 United States. FBI. Crime in the United States. Sept. 2006. 28 July 2009, [http://www.fbi.gov/ucr/05cius/offenses/expanded\\_information/data/shrtable\\_07.html](http://www.fbi.gov/ucr/05cius/offenses/expanded_information/data/shrtable_07.html)

#### Shotgun Shells, Touch DNA, Firearms