



### **B68 Examination of Factors That Affect the Recovery and Analysis of DNA From Spent Cartridge Casings**

*Rebecca Ray, BS\*, Michigan State University, 560 Baker Hall, East Lansing, MI 48824; Ashley M. Mottar, MS, 560 Baker Hall, East Lansing, MI 48824; and David R. Foran, PhD, Michigan State University, Forensic Science Program, 560 Baker Hall, East Lansing, MI 48824*

After attending this presentation, attendees will understand the effects a number of variables, including pre-processing for fingerprints, DNA isolation methods, and cartridge size, have on the retrieval and analysis of DNA from spent cartridge casings.

This presentation will impact the forensic science community by providing instruction on which DNA retrieval methods and other variables have the greatest influence on recovering and analyzing DNA from spent cartridge casings. The findings have the potential to influence methods used by practitioners and will aid in prioritizing samples based on the likelihood of recovering genetic information on the loader of a firearm.

Hundreds of thousands of crimes involving firearms are committed annually in the United States; therefore, it is extremely important to identify the person who fired a weapon.<sup>1</sup> The weapon itself is rarely found at a crime scene; however, spent cartridge casings are, which could potentially link the shooter to both the firearm and the crime. Some forensic laboratories have attempted to isolate and analyze DNA from spent cartridge casings, though this has met with little success. Recent research in this study's laboratory has shown that optimized DNA extraction methods can improve the number of Short Tandem Repeat (STR) alleles generated from spent casings, yet there are many other factors that have the potential to influence the recovery of genetic information, several of which were examined in this research.

The effect of cyanoacrylate fuming was studied by having volunteers load nine cartridges into the magazine of a firearm at the Michigan State Police Lansing Laboratory, firing the cartridges, and collecting the casings. One-third of the spent casings were fumed with cyanoacrylate on site, one-third were transported to the Michigan State University laboratory and fumed, and the remaining third were not fumed. DNA was recovered using a double-swab method, utilizing one wet and one dry swab, followed by an organic extraction procedure previously optimized in the laboratory. DNA yields were determined using an Alu-based real-time Polymerase Chain Reaction (PCR) assay, and STRs were analyzed using the Promega® PowerPlex® Fusion Kit. The number of alleles consistent with the handler (established via a buccal swab) and the percent profile recovered were calculated. Statistical differences among methods were determined using the Mann-Whitney test at a significance level of 0.05.

Swabbing strategies and the influence of cartridge size were also examined simultaneously. Volunteers loaded twelve rounds each of 0.22 and 0.45 caliber cartridges into magazines, the cartridges were fired, and the casings collected. Three of the casings were swabbed individually, while the remaining casings were cumulatively swabbed in sets of three. DNA was extracted, quantified, and STR profiles were produced as above.

Cyanoacrylate fuming had a negative effect on DNA yields, as non-fumed casings had a significantly higher DNA yield than fumed casings. This was confirmed by STR results, wherein non-fumed casings generated an average of 27 loader alleles, while casings fumed both on-site and in the laboratory produced a third as many. Cumulative swabbing recovered an average of 2.6pg/μL of DNA from the 0.45 caliber casings, which was significantly higher than the average 0.9pg/μL recovered through individual swabbing, thus allowing for more DNA to be added to PCR reactions. As a result, cumulative swabbing recovered a higher percentage of the loader's profile, averaging 25 loader alleles compared to 14 recovered through individual swabbing. Similarly, an average of 0.75pg/μL and 12 alleles were recovered from cumulatively swabbed 0.22 casings, while 0.4pg/μL and 6 alleles were recovered from individually swabbed casings. Regardless of swabbing strategy, 0.45 casings produced more DNA and more STR alleles than did 0.22 casings. Overall, each tested variable was found to have a substantial effect on DNA yields and STR profiles, and therefore needs to be strongly considered when DNA analysis from spent casings is undertaken.

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## Reference:

1. National Institute of Justice. Gun violence. <<http://www.nij.gov/topics/crime/gun-violence/Pages/welcome.aspx>> (accessed 07.16.2014).
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## DNA Recovery from Casings, Cartridge Casings, Touch DNA