



### **A192 You Can Wash, But Can You Hide? Generating DNA Profile From Low Template DNA**

*Reena Roy, PhD\*, Pennsylvania State University, Forensic Science Program, 325 Whitmore Lab, University Park, PA 16802; and Stephanie*

*H. Nickolas, MPS, and Lauren B. Williams, Pennsylvania State University, Eberly College of Science, University Park, PA 16802*

After attending this presentation, attendees will be able to optimize the generation of DNA profiles from low template DNA. When a stain has been washed and no longer visible, a profile from the stains can be obtained using a combination of various methods including touch evidence and low copy number DNA analysis.

This presentation will impact the forensic science community by providing information on bloodstains that have been washed with detergents containing a bleach alternative as well as stains that have been washed with regular detergent and chlorine bleach. The presentation will include the impact on the DNA profile using different materials and the methods used to obtain STR DNA profiles from these washed stains.

Forensic analysts often encounter situations in which perpetrators wash their clothing in an attempt to destroy blood and body fluid stains that may implicate their role in a particular crime. Victims of sexual assault may wash their clothing immediately following the attack, deciding days or weeks later to report the crime. Obtaining DNA profiles from these blood and body fluid stains, which have been subjected to washing and drying, will allow the forensic scientists to link the perpetrator to the crime. The aim of this research was to use different procedures, including LCN methodology, to generate DNA profiles from bloodstains that have been deposited on various types of fabrics and subjected to different conditions of washing.

Known quantities of blood from living and deceased donors were deposited onto swatches of several types of fabric. Each swatch of bloodstained fabric was allowed to dry for approximately 24-hours at room temperature. The stained pieces of fabric were placed into lingerie wash bag and then subjected to a hot wash cycle for 29 minutes using an automatic, commercially available washing machine with 45 mL of detergents containing a bleach alternative. Another set of washing was conducted on bloodstained fabrics using the same wash cycle, but with 45 mL of regular detergent and 90 mL of regular bleach. After washing, all of the fabric swatches were dried in an automatic, commercially available dryer for 60 minutes, using a high temperature cycle. Along with the stained fabrics, two sets of negative controls, or substrate controls, were created. The first set was not washed, but it was processed to determine if any DNA may have been introduced into the fabric during the manufacturing or handling processes. The second set was washed to determine if any DNA may have been introduced into the fabric during the washing and drying process. All washed pieces were tested for the presence of blood using presumptive tests. Confirmatory tests were then performed on the samples which previously reacted positively with presumptive tests.

DNA extractions from the washed, bloodstained fabrics were performed following a conventional organic extraction procedure, a robotic extraction procedure, and also by a touch evidence extraction procedure. Extracted DNA was quantitated, followed by amplification with parameters recommended by the manufacturer. Some of the extracted samples with low template DNA were amplified using a reduced reaction volume and an increased cycle number. Analysis of the amplified products was carried out by capillary electrophoresis injection and the generated profiles were analyzed using appropriate DNA analysis software.

Using the organic and robotic extraction procedures, it was possible to generate autosomal STR and Y-STR DNA profiles from the cotton fabric swatches, washed with detergents containing a bleach alternative. Using the touch evidence extraction procedure, it was possible to generate autosomal STR DNA profiles from some of the bloodstained cotton swatches washed with regular detergent and regular bleach. No autosomal or Y-STR DNA profile could be generated from some of the washed bloodstains, particularly those deposited on polyester fabric. None of the negative control samples showed any DNA profile.

The results indicate that cotton is able to retain bloodstains better than other types of fabric and allows the generation of better quality STR DNA profiles. When examining the type of detergent and its ability to generate a DNA profile from the washed bloodstains, the detergents with a bleach alternative did not wash away the bloodstains as effectively as when the stains were washed with regular detergent and regular bleach. Sodium hypochlorite and sodium hydroxide are two of the components found in the regular bleach that are not included in the detergents containing a bleach alternative and it is possible that these two components cause the DNA to degrade completely.

This study indicates that DNA profiles can be generated from bloodstains that have been subjected to washing and drying in automatic machines. Obtaining DNA profiles from this type of evidence can help in the investigation of a crime.

#### **LCN, Low Template DNA, Touch Evidence Extraction**