



Young Forensic Scientists Forum—2020

Y6 DNA Contamination From Handled Sharpie® Markers Used to Outline Bodily Fluids in a Forensic Laboratory

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Learning Overview: After attending this presentation, attendees will better understand contamination via DNA transfer caused in the laboratory and the impact this contamination has on interpreting data.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by identifying a method of introducing DNA contamination into the laboratory through common practice and how this can be prevented in order to reduce the likelihood of contamination as much as possible while processing evidence.

With the ever-increasing sensitivity of DNA technology, DNA transfer is more readily detected and observed in fragment analysis data. In a crime laboratory, forensic biologists are handling tools that can instigate this DNA transfer event, leaving traces behind on evidence. This research will determine whether forensic biologists transfer DNA from evidence to evidence using Sharpie® markers that outlined bodily fluids prior to DNA extraction.

Forensic biologists outline bodily fluids with markers before swabbing for further DNA analysis to visualize where the samples are located. This is especially important when the biological material is not visible to the naked eye, such as semen, and an Alternative Light Source (ALS) is required. The marker is used multiple times on separate pieces of evidence, which may or may not be from the same case. This transferring of DNA could contaminate evidence with DNA from separate individuals and from unrelated cases, creating more noise and mixture data interpretation in the fragment analysis results.

A preliminary study was employed to confirm DNA can be extracted from the tips of Sharpie® markers. To do this, human whole blood and human semen were deposited on blue denim and black T-shirt swatches. After the bodily fluid dried for at least one week, the Sharpie® markers were purposely drawn over the bodily fluids, using either a black Sharpie®, metallic silver Sharpie®, or white China Sharpie® marker, depending on the substrate color. The tip of the Sharpie® marker was then swabbed using a Puritan® cotton swab and the double-swab technique. Both a 5% Chelex extraction and a QIAGEN® DNA Investigator Kit were used to determine which extraction method was more efficient. Each sample combination was repeated in quintuplicate with a positive, negative, and substrate control for a total sample size of 128. The samples were quantified using the QuantStudio™ 5 Real-Time Polymerase Chain Reaction (PCR) instrument and the Quantifiler® Human DNA Quantification Kit. The GeneAmp® PCR System 9700 and GlobalFiler® PCR Amplification Kit were used to amplify all samples and a 3130 Genetic Analyzer was used to genotype the samples.

The results obtained from the preliminary study showed DNA can be extracted from Sharpie® markers. This study also showed the QIAGEN® DNA Investigator Kit yielded more efficient results, which were then utilized for further research. After the preliminary experiment, the mock scenario was implemented to re-enact a practical situation in a laboratory. This employed the same techniques; however, the clothing was donated to better simulate a practical situation. Additionally, reference samples were collected via buccal swabs from the individuals who donated the bodily fluid and clothing. The Sharpie® markers were used to outline the bodily fluids on up to three swatches containing biological material from a different source. The samples were extracted, and the data was compared to the reference samples to identify if the Sharpie® markers were transferring DNA in detectable quantities.

Identifying contributing factors to DNA contamination in a crime laboratory is imperative so that measures can be taken to prevent further contamination. This is especially critical for low copy number samples or samples that do not contain enough material for conservation. Recognizing and understanding all possible avenues of contamination will create a more sterile and safer environment for the processing of evidence.

DNA Transfer, Contamination, Fragment Analysis