

## F8 Indirect DNA Transfer: The Impact of Contact Length on Skin-to-Skin-to-Object DNA Transfer

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**Learning Overview:** After this presentation, attendees will appreciate the complex nature of DNA transfer. The goals of this presentation are to: (1) evaluate the indirect transfer of DNA to an object when a person serves as the vector of transfer, (2) to investigate the length of contact between two individuals that might result in the indirect transfer of DNA, and (3) to assess the impact of indirect DNA transfer on determining how evidence relates to a crime scene.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by demonstrating that indirect DNA transfer to an object can occur through brief skin-to-skin contact and that it can have a significant impact on understanding evidence in relation to a crime scene.

The following null hypotheses were tested: (Hn1) a single DNA profile of the direct handler will be the only DNA identified on each knife, and (Hn2) transfer DNA from the non-handler will result in an inconclusive profile unsuitable for statistical analysis.

The analysis of trace amounts of DNA from items possibly handled by a suspect during the commission of a crime often plays a crucial role in criminal investigations. In some cases, DNA left on an object can be the only link to the perpetrator. The increased capability to detect minute traces of DNA from a perpetrator at a crime scene has been a continuous goal of the forensic community. The increase in sensitivity in most cases is beneficial. However, it can also lead to the detection of extraneous DNA not related to the forensic investigation, which can complicate the identification of a suspect and increase the uncertainty of its evidentiary value.<sup>1</sup>

Empirical research has not only demonstrated the primary transfer of DNA via direct contact with an object, but also the indirect transfer of DNA whereby an individual's DNA is transferred to an object or another individual via an intermediary. The indirect transfer of DNA as an explanation for the presence of trace DNA samples at a crime scene appears to be becoming more prevalent in forensic investigations and during subsequent court proceedings.

This scientific research used handshaking to simulate contact that could lead to the indirect transfer of DNA. Participants shook hands continuously for varying lengths of time: 10 ( $n=24$ ), 30 ( $n=24$ ), 60 ( $n=24$ ), and 120 ( $n=24$ ) seconds. Knives were handled immediately following handshaking and were sampled after two minutes of handling. The samples were analyzed and interpreted following standard operating procedures.<sup>2</sup>

Data was obtained from 92 of 96 samples. Interpretable DNA profiles were obtained from 48 samples. The DNA yields for samples that resulted in interpretable profiles ranged from 50pg to 5ng. In 69% of the interpretable profiles, single-source profiles or mixed DNA profiles with the major component matching the primary contributor were obtained. Contributor inversions, where the non-handler matched the major component of a mixed DNA profile were observed: five at 120 seconds, four at 30 seconds, and one at 10 seconds. Indistinguishable mixtures of both contributors were obtained from four samples, making it difficult to identify the direct knife handler. In the remaining 44 samples, the presence of non-handler DNA and/or extraneous DNA rendered the profiles inconclusive.

The results of this scientific research support the concept that the identification of a DNA profile on an object cannot be considered proof of direct contact. Likewise, the amount of DNA recovered and/or the quality of the DNA profile obtained from an object cannot be used to infer the mode of transfer.<sup>3</sup> In addition, these results demonstrate that under experimental conditions that maximize DNA transfer and recovery, indirect DNA transfer to an object can occur with as little as ten seconds and as much as two minutes of continuous skin-to-skin contact.

The presence of indirectly transferred DNA on an object can make the identification of the direct handler difficult. DNA transfer does not render DNA evidence unreliable but represents an additional level of complexity in the analysis and interpretation of DNA profiles. Forensic DNA analysts should provide the court with an unbiased list of all possible modes of DNA transfer. In addition, forensic DNA analysts need to proceed with caution when addressing activity-level questions and base their opinions on published peer-review data rather than giving anecdotal responses.<sup>1,4,5</sup>

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### Transfer DNA, Indirect DNA Transfer, DNA Evidence Interpretation

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