## B120 The Impact of the Length of Time of Personal Contact on Secondary DNA Transfer

*Cynthia Cale, BS*, Strand Diagnostics, 5770 Decatur Boulevard, Ste A, Indianapolis, IN 46241; Krista E. Latham, PhD, University of Indianapolis, Biology Dept, 1400 E Hanna Avenue, Indianapolis, IN 46227; and Gay L. Bush, PhD, Strand Diagnostics, 5770 Decatur Boulevard, Ste A, Indianapolis, IN 46241*

After attending this presentation, attendees will appreciate how much contact may be necessary for secondary DNA transfer to occur and the potential impact on forensic investigations. The learning objectives are to evaluate the detection of secondary DNA transfer using next generation amplification kits, to investigate the length of contact time that might result in secondary DNA transfer, and to assess the impact of secondary DNA transfer on determining how evidence relates to a crime scene. The hypotheses are that secondary DNA transfer: (1) can occur during brief periods of contact; and, (2) can complicate interpretation of DNA evidence.

This presentation will impact the forensic science community by demonstrating that secondary DNA transfer can occur during brief encounters and that it can have a significant impact on understanding evidence in relation to a crime scene.

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 a touched 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. While enhancing the sensitivity of Short Tandem Repeat (STR) kits to increase the likelihood of obtaining results from trace DNA samples, there also appears to be a simultaneous increase in the detection of extraneous DNA, the presence of which can complicate the identification of a suspect.

Empirical research has not only demonstrated the primary transfer of DNA via direct contact with an object, but also the secondary 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 the subsequent court proceedings. In Europe, the focus of forensic investigation appears to be moving toward not only identifying the source of a DNA profile, but identifying how the DNA was deposited on an evidentiary item — directly or indirectly.[1,2]

Expanding upon the Cale et al. study by introducing additional variables, this project used handshaking to simulate contact that could lead to secondary DNA transfer.[3] Participants shook hands for varying lengths of time: 10, 30, and 60 seconds. Plastic knives were handled immediately following contact. The knife handles were subsequently sampled for DNA using a wet swabbing technique. The samples were amplified with the GlobalFiler® Polymerase Chain Reaction (PCR) Amplification Kit and analyzed on an ABI® 3130xl genetic analyzer. The Mixture Analysis Tool within GeneMapper® ID-X version 1.5 was utilized to facilitate data interpretation.

Data was obtained from all samples ($n$=72). Interpretable DNA profiles were obtained from 38 samples. The DNA yields for samples that resulted in interpretable profiles ranged from 50pg to 3ng. In 26 of the 38 interpretable profiles, single-source profiles or mixed DNA profiles with the major component matching the primary contributor were obtained. Five contributor inversions were observed, where the secondary contributor matched the major component of a mixed DNA profile. Indistinguishable mixtures of both contributors were obtained from seven samples, making it difficult to identify the primary handler of the knife. In the remaining 34 samples, the presence of alleles from the secondary contributor and/or extraneous DNA rendered the profiles inconclusive. Consequently, secondarily transferred DNA complicated the interpretation of DNA typing results in those samples.

Mixed DNA profiles are often obtained from trace DNA samples in which multiple handlers of an object can be detected. Typically, the greatest proportion of the DNA comes from the most recent handlers, but not necessarily the last handler.[4] In some instances, an individual who did not directly handle the object can be detected. The results of this study demonstrate that under certain conditions, secondary DNA transfer can occur during brief interactions. The presence of DNA transferred through an intermediary to an object can make the identification of the primary handler of an object difficult. Forensic DNA analysts need to be cautious when assessing the likelihood of one mode of transfer over another as an explanation for the presence of an individual's DNA at a crime scene.

**Reference(s):**

1. Evett, Ian W., Peter D. Gill, Graham Jackson, Jonathan Whitaker, and Christophe Champod. Interpreting small quantities of DNA: the hierarchy of propositions and the use of Bayesian networks. *Journal of Forensic Sciences. 47*, no. 3 (2001): 520-530.
2. Kokshoorn, Bas, Bart J. Blankers, Jacob C. De Zoete, and Charles EH Berger. Activity level DNA evidence evaluation: on propositions addressing the actor or the activity. *Forensic Science International.* (2017).
3. Cale, Cynthia M., Madison E. Earll, Krista E. Latham, and Gay L. Bush. Could secondary DNA transfer falsely place someone at the scene of a crime? *Journal of Forensic Science.s* 61, no. 1 (2016): 196-203.
4. Buckingham, Alycia K., Michelle L. Harvey, and Roland AH van Oorschot. The origin of unknown source DNA from touched objects. *Forensic Science International: Genetics.* 25 (2016): 26-33.

**Transfer, Trace DNA, GlobalFiler®**



*Presenting Author