F7 The Strengths and Limitations of Transfer DNA Evidence Recovered From Objects Handled by Multiple Individuals

Leann G. Rizor, BS, Ypsilanti, MI 48197; Jonah W.P. Stone, BS, Indianapolis, IN 46241; Krista E. Latham, PhD, University of Indianapolis, Indianapolis, IN 46227; Cynthia Cale, MS, Strand Diagnostics, Indianapolis, IN 46241; Gay L. Bush, PhD, Strand Diagnostics, Indianapolis, IN 46241*

Learning Overview: After attending this presentation, attendees will better understand the strengths and limitations of transfer DNA evidence in situations in which multiple people handled the same objects and in which multiple DNA transfer events occurred. The goal of this presentation is to demonstrate the difficulty of predicting the mode of DNA transfer and handling order from DNA evidence.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by adding to a growing body of knowledge regarding transfer DNA and DNA evidence interpretation in medicolegal investigations.

Advances within the field of forensic science have allowed for an increase in the sensitivity of various technologies involved in the detection and typing of DNA evidence. As this sensitivity increases, so does the likelihood of detecting and amplifying DNA not associated with the criminal act. To better understand, explain, and interpret DNA recovered from evidentiary items, one must have a comprehensive understanding of the active and passive processes that lead to DNA deposition, as well as the numerous variables that influence the transfer of DNA between individuals and objects. Recently, there has been an increase in the number of transfer DNA samples submitted to forensic DNA laboratories for analysis. As a result, scientific studies regarding transfer DNA need to be conducted to better understand the strengths and limitations of transfer DNA evidence. Conducting systematic studies that test the limits of DNA transfer, understanding the factors that influence DNA transfer, and furthering the understanding of DNA transfer in various real-world scenarios will only act to bolster the interpretation of scientific evidence presented in criminal investigations.

This study expands upon transfer DNA research conducted by Goray and van Oorschot and explores the transfer of DNA in a simulated social setting.[1] Four participants handled pre-sterilized plastic objects (a jug and four cups). This served to simulate a social event in which multiple people pour beverages from the same jug in an open-air setting, as would be encountered in a restaurant or bar. The order and timing of handling were predetermined and controlled by the researchers to test for the various modes of DNA transfer (primary, secondary, and tertiary). The current study tests the following null hypotheses: (1) secondary DNA transfer will not occur and will not be detected on dominant hands, (2) tertiary DNA transfer will not occur and will not be detected on the cups, (3) a mixed DNA profile from all participants will not be found on the jug handle, and (4) the order of handling the objects cannot be discerned from the DNA data. The dominant hands of the participants as well as the cups and jug were swabbed at various times throughout the study to test for evidence of DNA transfer. The DNA was analyzed and interpreted following standard operating procedures.

DNA was detected in 92% of the samples collected in this study. However, only 50% of those profiles met casework requirements for interpretation utilizing the laboratory's current interpretation guidelines. Eighty percent of these samples were mixtures containing DNA from two or more contributors, and 60% had identifiable major and minor contributors. There was no correlation found between the DNA profiles obtained from the handled objects and the timing or length of contact the participants had with those objects. For the samples obtained from the participant's hands, the major profiles produced were consistent with the individual from which the swab was taken. Seventy-five percent of the profiles obtained contained extraneous DNA leading to complex mixtures.

These results illustrate the complex nature of interpreting DNA transfer that occurs in a social setting involving multiple individuals and multiple transfer events. In this study, the objects were pre-sterilized, the order of handlers and length of contact was recorded, and the handlers' profiles were known. Despite these controlled aspects, the order and timing of handling could still not be reconstructed from the DNA profile information. This study demonstrates the ease of DNA transfer between objects and individuals, illustrates the difficulty in predicting mode of DNA transfer based on the DNA typing results, and highlights the difficulty in interpreting the genetic data when multiple transfer events have occurred.

Reference(s):

1. Mariya Goray and Roland A.H. Van Oorschot. DNA Transfer During Social Interactions. *Forensic Science International: Genetics Supplement* Series 4 no. 1, (2013) doi:10.1016/j.fsigss.2013.10.052.

DNA Transfer, DNA Evidence, DNA Mixtures