Title: Understanding the sensitivity of DNA testing required to avoid detecting secondary DNA transfer in samples

Background of the Study:

One of the most common ways to identify criminals is by collecting DNA from a crime scene and tracing it back to the people who were present before or during the criminal events. For a long time, this has been a significant method for tracking down criminals and solving cases. With the advent of several sensitive techniques for detecting and analyzing DNA, even trace amounts of DNA from a crime scene can easily be retrieved and tested (Taylor *et al*., 2017). This was considered the gold standard for crime scene investigation until 1997 when van Oorschot and Jones described the secondary transfer of DNA, wherein a person may carry the DNA of another person that s/he acquired through a handshake or other physical contact and deposit it at a crime scene. This means that DNA of a completely innocent and unrelated person may turn up at a crime scene, and people may get falsely accused of crimes they did not commit (van Oorschot and Jones, 1997). Following this report, several groups of scientists have attempted to disprove the theory that secondary transfer of DNA may complicate forensic DNA investigation. In all these studies, scientists have found the presence of trace amounts of secondary DNA in the form of a few alleles. However, there is still no consensus on how much can the presence of secondary DNA disrupt forensic DNA analysis proceedings (Cale *et al*., 2016).

Purpose and Objectives of the Study:

This study aims to analyze the amount of DNA that is available through primary and secondary DNA transfer. This knowledge can be used to determine the sensitivity of DNA testing kits required to detect both primarily and secondarily transferred DNA.

1. To identify the quantities of primarily and secondarily transferred DNA at crime scenes
2. To determine the sensitivity of DNA testing kits required to detect trace amounts of primarily transferred DNA
3. To devise an analysis method that will only detect and amplify primarily transferred DNA in a sample

Research Hypotheses:

1. The amount of DNA transferred secondarily is far less as compared to the amount of DNA transferred primarily.
2. The difference in the amounts of DNA transferred through primary and secondary means can enable the selective amplification of DNA that is present in larger quantity.

3. Based on the quantities of different DNA profiles present in the sample, it will be relatively easy to determine the DNA transferred through primary and secondary means.
4. Available DNA testing kits with a lesser degree of sensitivity may not be able to detect trace amounts of secondary DNA transferred to a crime scene.
5. The DNA transferred through secondary means will show more damage and fragmentation as compared to DNA transferred through primary means.

References:

Cale, C. M., Earll, M. E., Latham, K. E., & Bush, G. L. (2016). Could Secondary DNA Transfer Falsely Place Someone at the Scene of a Crime? *Journal of Forensic Sciences*, *61*(1), 196–203. doi: 10.1111/1556-4029.12894

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van Oorschot, R. A. H., & Jones, M. K. (1997). DNA fingerprints from fingerprints. *Nature*, *387*(6635), 767–767. doi: 10.1038/42838