TOUCH DNA IN FORENSIC SCIENCE: INFORMING ACTIVITY-LEVEL PROPOSITIONS

Kristina Bozin MS[1], Kaitlin Keller MS[1], Nivida Shete MS[1], Megan Tyahla BS[1], RayWickenheiser DPS[2], Ashley Hall PhD[1]
[1]University of Chicago at Illinois, Department of Pharmaceutical Sciences
[2]New York State Police Crime Lab System

Alternate scenarios to explain why a suspect's DNA is found at a crime scene is a commonform of defense. Evaluating each scenario provides tremendous value when it can be backed by objective data. Integral to an increasing number of scenarios is touch DNA evidence. In many cases, the strength of the DNA evidence is such that the identity of the donor can't be reasonably disputed, rather the activities that resulted in the DNA transfer become the subject of intense debate. Evaluations of the evidence given the donor's activities inform activity-level propositions**,**addressing how the sample got there, rather than simply who it belonged to.

Critical touch DNA activity-level variables include DNA-TPPR (transfer, persistence, prevalence, recovery). Quantification of DNA recovery was used as a tool to explore the persistence of DNA in fingerprints in the wild, i.e. directly deposited by donors. The study included three variables: 1) surface: porous/non-porous; 2) temperature: room temperature/37°C; and 3) time from deposition to collection: 0 – 21 days. Wild fingerprints were visualized with twonucleic acid dyes, collected and the DNA quantified by QPCR. On a porous surface at room temperature, mean recovery over a 21-day period ranged 0.0047 – 0.062 ng per fingerprint, and from 0.0058 – 0.30 ng per fingerprint at 37°C. On a non-porous surface at room temperature, therecovery range was 0.066 – 0.49 ng per fingerprint. At 37°C, it was 0.048 – 0.20 ng per fingerprint. Line graphs of DNA Recovered vs Time Since Deposition showed no trends, with no significant variance in DNA persistence over time, on either surface or at either temperature. These results highlight the difficulties inherent in the analysis of touch DNA, with its high inter- and intra-personvariability in DNA content.

A mock eccrine fingerprint containing a known quantity of DNA was reported previously(FSI: Synergy; 2; 2020). It removed the "DNA deposited" variable and allowed researchers to better track DNA recovery and loss through collection and analysis. The protocol has been expanded to include sebaceous fingerprint components to more closely approximate a fingerprintin the wild. To validate the protocol, DNA recovery from twenty replicate samples at each of fiveDNA concentrations was quantified. The mean values were plotted as standard curves (DNA Recovered vs DNA Deposited), with resulting R^2 values ranging from 0.9837 -0.999.

To further reduce the variability in touch DNA experiments, a mock hand for sample deposition has been developed. Artificial epidermis is molded over a nitrile glove supported on aplaster cast of a researcher's hand. In experiments, the researcher wears the glove and deposits a sebaceous mock fingerprint of known DNA content to evaluate DNA-TPPR variables. The use ofthe domesticated (mock) fingerprints and artificial hand should closely approximate touch samplesin the wild in future experiments, providing researchers with a reliable method for generating objective data to inform activity-level propositions.