

FORENSIC ASPECTS OF TRACE HUMAN BLOOD EVIDENCE: FROM PRESUMPTIVE TEST TO STR PROFILE

Christine E. Lemire¹ and Dr. Frederick Bieber²

¹*Massachusetts State Police Crime Laboratory, Sudbury, MA*

²*Harvard Medical School, Boston, MA*



The investigation generated and interpreted STR DNA profiles from simulated forensic evidentiary blood samples which were assessed as positive using presumptive tests for blood (i.e. ortho-tolidine and phenolphthalein tests) but did not appear to contain blood by visual inspection. These very limited DNA samples challenge the limits of PCR-based STR DNA typing technology and pose the question of whether a non-visible bloodstain collected from a crime scene will yield sufficient DNA for STR profiling. Initially, experiments (Control Studies) were performed to determine the most effective detection, collection, extraction, concentration, and CE analysis methods to use on limited blood samples. It was determined that once a trace bloodstain is detected utilizing a presumptive test, it is best to collect that stain with a swab, extract the DNA on that swab utilizing an organic-based method, concentrate the entire DNA extract, and use the entire extract for PCR amplification. Data from these studies supported that a full Profiler Plus™ DNA profile can be obtained from 100 µL of a dried 1:2,560 dilution of blood (a non-visible quantity); this equates to approximately 1.9 ng of starting DNA or a mere 0.03 µL of fresh blood. In addition, it was determined that full Profiler Plus™ DNA profile can be obtained from a sample which yields a negative result in the Quantiblot® human DNA quantitation method and an increased CE sample injection time (ten seconds) can provide additional accurate profile information as compared to the typical five second sample injection time. Use of the OneStep ABACard® HemaTrace™ human hemoglobin (hHb) detection device was also evaluated in this study. The device can be utilized successfully as a combined hHb/DNA assay. This allows for the detection of hHb in a limited blood sample while preserving most of the DNA in that sample for DNA profiling. Further studies in this research project identified the ability to detect DNA on handled objects (i.e. areas of vehicles) and from swabbings of a subject's clean hands. Finally, mock "crime scenes" provided data that support the collection of trace, non-visible quantities of a "victim's" blood from areas of a "suspect's" vehicle and from a "suspect's" hands soon after a crime. Partial to full Profiler Plus™ DNA profiles of the "victim's" blood (a non-visible quantity) were obtained from areas of the "suspect's" vehicle and from swabbings of each of the "suspect's" hands (after they had been washed with running tap water) in the mock "crime scenes". Implications of the data are discussed.