B119 Forensic Identification: An Investigation to Corroborate Volatile and Biological Profiles for Subject Identification

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Learning Overview: After attending this presentation, attendees will understand that the unique microbial composition on an individual's hand determines the person's Volatile Organic Compound (VOC) profile.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the potential for an idiosyncratic profile that combines chemistry (VOCs) and biology (DNA) as a viable resource for forensic identification. This resource/tool increases the potential for trace samples to discriminate between individuals at a crime scene.

Hands are an integral part in transferring cellular material, both human and microbial, to and from our surroundings. As a result, hands are significant in provenance investigations as specific microbiota can be deposited on everyday objects through touch interactions. Skin microbiome, including bacteria, fungi, and viruses, are unique to each person, and this "uniqueness" can be exploited and applied to forensic identification. Skin microbiota and VOCs are intrinsically linked due to microbial metabolic transformation of non-volatile organic compounds to VOCs that are characteristically represented in human scent. The ribosomal operons within bacteria are ubiquitously present and easy to amplify through Polymerase Chain Reaction (PCR) because of its highly conserved primer sites and plethora of phylogenetic information. Traditionally, the small sub-unit of the prokaryotic ribosome encoding the 16S) recombinant DNA (rDNA) gene is used to identify bacterial species. However, analyses of microbiota from touch interactions have proven to be difficult due to the low quantity of genomic DNA (gDNA) that can be collected and extracted.

Headspace/Solid Phase Microextraction-Gas Chromatography/Mass Spectrometry (HS/SPME-GC/MS) is commonly used to conduct VOC analyses of air and water samples. Previous studies have utilized HS/SPME-GC/MS as a forensic approach to examine VOCs collected from various regions of the body as a form of identification. The objective of this research is to analyze samples collected from the subject's palms to determine the relationship between the individual's bacterial genetic profile and the VOC profile. Palmar sweat samples and epithelial swabs were simultaneously collected for VOC and DNA analysis, respectively. DNA was initially screened using Length Heterogeneity Polymerase Chain Reaction (LH-PCR) to obtain an initial assessment of the bacterial community's diversity. Next generation DNA sequencing of the V3-V4 region of the 16S rDNA gene was performed to identify each individual species present. Preliminary data have also demonstrated the ability to provide human Short Tandem Repeat (STR) markers from the same samples that will enhance the information collected from corroborated profiles.

Whereas previous standalone touch DNA analysis and standalone VOC analysis has proven to be challenging and limited in the information it provides, concatenation of these combined data will allow for the advancement of human scent studies for forensic identification.

Volatile Organic Compounds (VOCs), Human Microbiome, SPME

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