H125 Evaluating the Skin Microbiome as Trace Evidence on Common Surface Types

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After attending this presentation, attendees will understand the reproducibility of hand microbial communities that are transferred to multiple surface types. Attendees will be presented with results from recent skin transfer experiments in which it was determined whether or not surface type (metal, wood, ceramic, glass, and plastic) affects the ability to transfer a person's unique skin microbial signature to a surface.

This presentation will impact the forensic science community by revealing basic transfer properties of an individual's unique skin microbial community to common surface materials, which has potential as trace evidence for criminal investigators.

The skin microbiome is highly individual, to the extent that two people's hands can differ in more than 80% of the types of microbes found. A previous study determined that people's personalized microbial communities are transferred to objects, such as computer keyboards and surfaces in the physical spaces people inhabit. Importantly, the composition of a person's skin microbial community appeared generally stable over time. As a result, skin microorganisms have great potential to serve as trace evidence, and they are uniquely positioned to augment friction ridge comparison when sufficient ridge detail is not available to make a positive identification. Thus, the potential for microorganisms to reveal whether a particular person has touched an object or has recently been in a space is substantial.

This study hypothesized that some surface types will maintain a person's skin microbial signature better than others. It is well known among forensic scientists that friction ridges are harder to recover off some types of surfaces than others. In a similar manner, it is hypothesized that surface types may vary in their ability to receive or retain skin microbial communities after contact. To test this hypothesis, skin transfer experiments were carried out at the University of California San Diego (UCSD). To characterize each participant's unique skin microbial signature, skin from each participant's hand was swabbed for five days leading up to the experiment. The ability for skin microbes to transfer to metal, wood, ceramic, glass, and plastic tiles was tested by swabbing sets of tiles immediately after they were touched. Each participant in the experiment touched five tiles of each surface type. Each tile was only touched one time. Additionally, untouched control tiles of each surface type were swabbed.

All swabs were stored at -20°C until DNA extraction using the MoBio PowerSoil DNA isolation kit following the Earth Microbiome Project (EMP) standard protocols. 16S ribosomal RNA (rRNA) Polymerase Chain Reaction (PCR) amplicons were generated from each sample, multiplexed, and sequenced on the Illumina® HiSeq™ 2500 platform at UCSD. Sequence data were processed and analyzed using the Quantitative Insights into Microbial Ecology (QIIME) bioinformatics open-source software. Resulting sequences were classified into Operational Taxonomic Units (OTU) and identified to known taxonomy using the Greengenes reference database. Phylogenetic metrics were used to estimate alpha diversity and beta diversity. Supervised learning and Bayesian source-tracking methods were used to estimate the ability to accurately link surface microbial communities with a participant in the experiment. Microbial communities recovered from tiles were compared to those sampled from each participant's hand previous to the experiment as well as to untouched control tiles. Results will be presented.

The results provide a robust basis for understanding whether microbial trace evidence has potential for crime scene investigation.

Skin Microbiome, Trace Evidence, Bacteria