

Bacterial forensics: Tracing a suspect from the microbes on their shoes

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The microbial 'signatures' found on an individual's personal items, such as their shoes and cell phone, could be used to determine their previous location and trace their movements, according to a small pilot study published in the open access journal *Microbiome*.

Bacteria found on human skin plays a role in shaping the [microbial ecology](#) of our homes, offices, hospitals and cities, through the objects we touch. Studying this microbial exchange between humans and their environment has potential applications in forensics, as microbial signatures found on personal items could be used to identify suspects in criminal investigations.

Study author Simon Lax of Argonne National Laboratory and University of Chicago, USA, said: "Human microbial signatures have already been used to match individuals to objects they've interacted with, such as computer keyboards. Now we're interested in seeing how these [microbial interactions](#) change over time, and whether they could be used to track an individual's movements. We found that even moving from one's own living room to a friend's living room leads to a highly detectable shift in microbial community structure on an individual's personal items."

In the study, two participants used sterile swabs to sample the front and back of their cell phones, the soles of their shoes and the floor beneath them, every waking hour over a two-day period. The swabs were later analyzed to determine the communities of bacteria present at each point.

Between each location over the two days, the researchers found that changes in the shoe [microbial communities](#) closely resembled those that were seen in the floor microbial communities. This suggests a strong and immediate impact from the floor microbial community on the individual's shoes.

The authors say they were surprised at how strong and distinct the shoe microbial signatures were in each location visited by the participant. This was further demonstrated with the success of their computer learning models in being able to identify each participant based solely on their samples.

According to their results, it is less likely that cell phones could be used to track a person's recent movements, due to the constant and rapid turnover of the microbial community on its surface.

A further 89 participants were randomly selected from attendees at three different scientific conferences and asked to donate samples taken from their shoes and phones.

The researchers found that the 'signature' of microbial communities, found on shoes and cell phones, could be clustered into distinct groups according to the geographic locations of the three separate conferences from where they were sampled.

The results therefore suggest that microbial communities show unique structure and composition based on surface type, the identity of the person interacting with the surface and geographic location.

Simon Lax said: "Microbial forensics is an emerging field and many more studies are needed to better understand its potential utility. This current study is a small pilot, and so a major priority will be scaling up the number of individuals in these sorts of studies, and seeing if we're

still able to match people to objects with high precision."

More information: Simon Lax, Jarrad Hampton-Marce, Sean M Gibbons, Geórgia Barguil Colares, Daniel Smith, Jonathan A Eisen and Jack A Gilbert Forensic analysis of the microbiome of phones and shoes, *Microbiome* 2015. [DOI: 10.1186/s40168-015-0082-9](https://doi.org/10.1186/s40168-015-0082-9)

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