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Exhaled breath is unique fingerprint

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Compounds present in exhaled breath can act as a "fingerprint" for individuals, scientists say.

These "metabolites" represent the waste products of the body's chemistry - but their uniqueness had never been shown.

A **study in PLOS ONE** suggests they could be as useful to medical diagnosis as those found in urine or blood.

Because a breath test is non-invasive and the results are instantaneous, it could prove even more convenient for example in anaesthesia or doping tests.

"I don't understand why breath hasn't been a widely used [means of] medical science diagnosis," said the study's lead author Renato Zenobi of the Swiss Federal Institute of Technology (ETH) in Zurich.

"In traditional Chinese medicine, they feel your pulse, look at your tongue and smell your breath," he told BBC News. "There are trained dogs who **can sniff cancer with a fairly good hit-rate** - but the dog doesn't tell you what the compounds are."

Prior work has shown that **the precise type of bacteria responsible for lung infections** or even **the presence of stomach cancer** could be discerned in the breath.

What remained to be seen was whether the breath's metabolic contents varied enough between people - and varied little enough within an individual - to be diagnostic - to act as a real and repeatable "breathprint".

"You need to show there is a core individual signal that is stable over time," Prof Zenobi said. "If it changes a lot during the course of the day or after you've had a coffee or smoked a cigarette, you can just forget about it."

Personalised medicine

The team acquired breath samples from 11 volunteers across four time slots of nine working days.

These samples were run through a mass spectrometer - a device that effectively measures all the masses of the chemical compounds in the breath.

Some, such as water vapour and carbon dioxide, were the same across all participants, but those that differed proved to be unique to individuals - and to stay the same for those individuals throughout the course of the experiments.

In the course of previous work, one of the collaborators' breath appeared to have one markedly different mass "peak" - which turned out to be connected to epilepsy medication he was taking.

When other patients on the same drug were tested, the same peak was found: a new metabolite of the drug that was subsequently **published in the journal Chemical Communications**.

It is the non-invasive and immediate nature of the test that makes it most promising.

It could for example help determine an appropriate dosage in anaesthesia, where an effective but safe dose is dependent on a patient's tolerance and metabolic rate - a small dose could be given to test how it is metabolised. A quick, at-the-starting-line test could be administered to check for doping in sport.

As the tests continue and the stability and uniqueness of each individual's breathprint is further verified, it could become a staple of the long-predicted "personalised medicine", tailored to each person's chemistry.

And the testing equipment - currently a large, laboratory-based system - is likely to be miniature.

For now the team is taking steps toward that goal, working with pulmonologists to detect signs of lung diseases such as asthma, sarcoidosis and cancer in the breath.

"We're at the onset of learning about what the compounds are. Just a small fraction of the peaks that we see are identified at this point, so there's a lot of footwork to be done," Prof Zenobi said.

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