# Sniffing out your identity with breath biometrics

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Breath odor-based individual authentication using an artificial olfactory sensor could become possible in the near future as represented by this artist's rendering. Credit: Kyushu University/Yanagida Lab

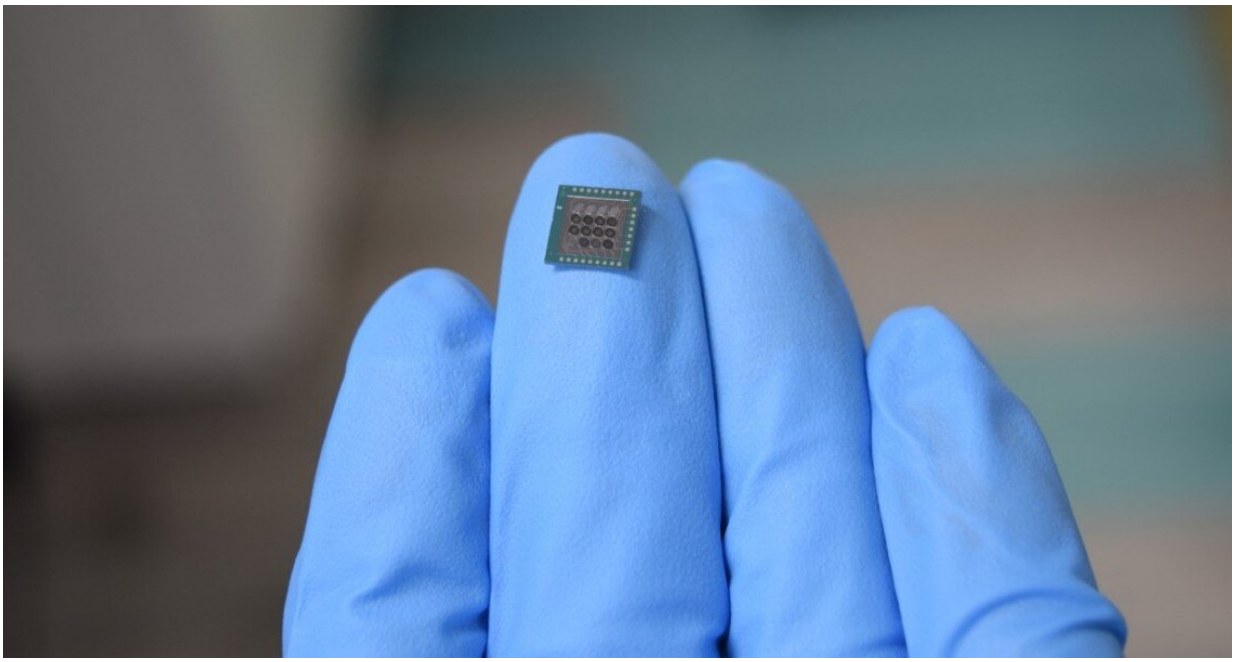
Biometric authentication like fingerprint and iris scans are a staple of any spy movie, and trying to circumvent those security measures is often a core plot point. But these days the technology is not limited to spies, as fingerprint verification and facial recognition are now common features on many of our phones.

Now, researchers have developed a new potential odorous option for the biometric security toolkit: your breath. In a report published in *Chemical Communications*, researchers from Kyushu University's Institute for Materials Chemistry and Engineering, in collaboration with the University of Tokyo, have developed an olfactory sensor capable of identifying individuals by analyzing the compounds in their breath.

Combined with machine learning, this "artificial nose," built with a 16-channel sensor array, was able to authenticate up to 20 individuals with an average accuracy of more than 97%.

In this age of information and technology, biometric authentication is a critical way to safeguard valuable assets. From the usual suspects of fingerprints, palm prints, voices, and faces to the less common options of ear acoustics and finger veins, there are a variety of biometrics that machines can use to identify you.

"These techniques rely on the physical uniqueness of each individual, but they are not foolproof. Physical characteristics can be copied, or even compromised by injury," explains Chaiyanut Jirayupat, first author of the study. "Recently, human scent has been emerging as a new class of biometric authentication, essentially using your unique chemical composition to confirm who you are."



Picture of an artificial olfactory sensor used for biometric authentication based on breath. The sensor is made of a 4x4 channel array for a total of 16 sensors. Each sensor detects a specific range of compounds found in human breath. The data is then processed by a neural network, which then determines the individual. Credit: Kyushu University/Yanagida Lab

One such target has been percutaneous gas—compounds produced from your skin. However, these methods have their limits because the skin does not produce a high enough concentration of volatile compounds for machines to detect.

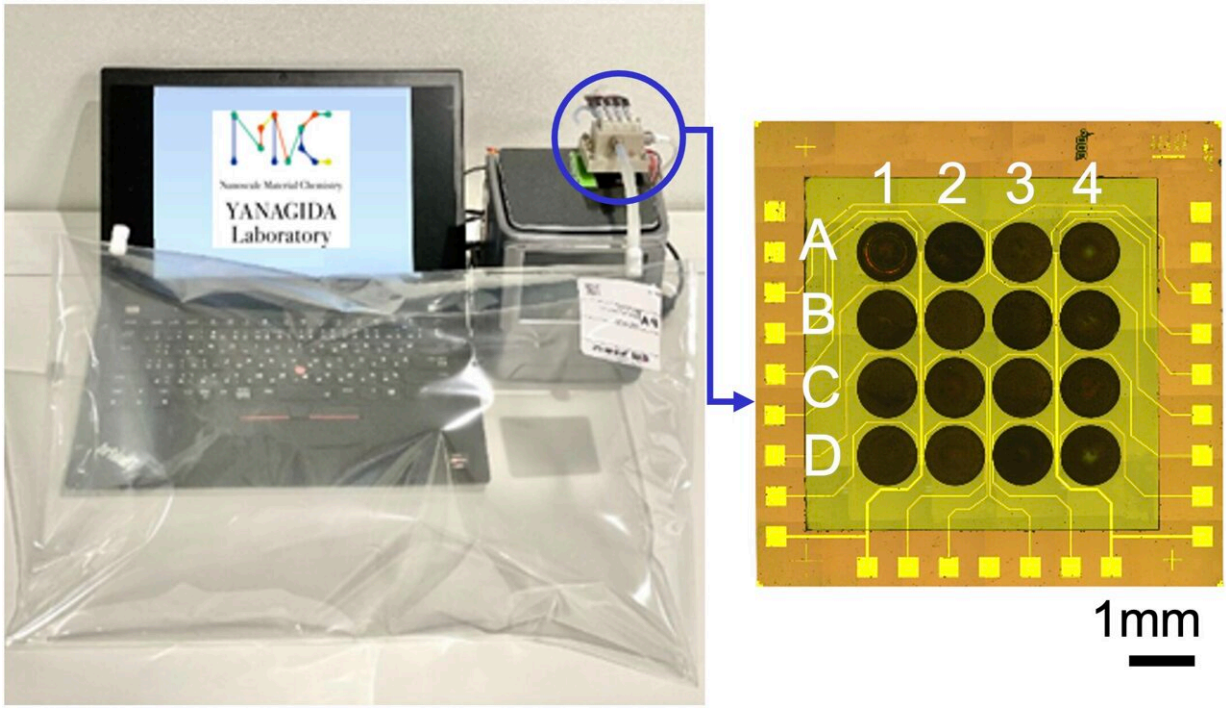
So, the team turned to see if human breath could be used instead.

"The concentration of volatile compounds from the skin can be as low as several parts-per-billion or trillion, while compounds exhaled from the breath can go as high as parts-per-million," continues Jirayupat. "In fact, human breath has already been used to identify if a person has cancer,

diabetes, and even COVID-19."

The team began by analyzing the breath of subjects to see which compounds could be used for biometric authentication. A total of 28 compounds were found to be viable options.

Based on this, they developed an olfactory sensor array with 16 channels, each which could identify a specific range of compounds. The sensor data was then passed into a machine learning system to analyze the composition of each person's breath and develop a profile to be used to distinguish an individual.




Subjects begin by breathing into a collection bag. The bag is then connected to the olfactory sensor, which analyzes the compounds found in the individual's breath. Based on the concentration of the compounds, the machine learning system identifies the individual. Credit: Kyushu University/Yanagida lab

Testing the system with breath samples from six people, the researchers found it could identify individuals with an average accuracy of 97.8%. This high level of accuracy remained consistent even when the sample size was increased to 20 people.

"This was a diverse group of individuals of differing age, sex, and nationality. It's encouraging to see such a high accuracy across the board," explains Takeshi Yanagida who led the study.

Nonetheless, he admits that more work is needed before it arrives on your next smartphone.

"In this work, we required our subjects to fast six hours before testing," concludes Yanagida. "We've developed a good foundation. The next step will be to refine this technique to work regardless of diet. Thankfully, our current study showed that adding more sensors and collecting more data can overcome this obstacle."

**More information:** Chaiyanut Jirayupat et al, Breath odor-based individual authentication by an artificial olfactory sensor system and machine learning, *Chemical Communications* (2022). DOI: 10.1039/d1cc06384g

Provided by Kyushu University