

Up to a fifth of the world's population has partial or total loss of smell. © DimaBerlin, Shutterstock.com

Smell trouble: the fight for the powers of the nose

Researchers are seeking to ensure that people retain their ability to detect scents.

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A decade ago, in a field of orange trees in southern Greece, Stéphane Tawil realised that he had lost his sense of smell – completely.

Tawil was with friends who were remarking on the perfumed scent of oranges. But he couldn't smell anything.

Costly condition

'I got a cold before this and when you have a cold you usually lose that sense of smell,' Tawil said. 'I remember not paying much attention to it. But then it lasted for quite a while.'

At that time, Tawil joined as much as 20% of the world's population with total or partial loss of the sense of smell. The affected part of the human body is the olfactory system, which includes the nose and nasal cavities.

While it occurs naturally with age, loss of smell can also be caused in younger people by a variety of factors such as viral infections and nasal obstruction or trauma.

In any case, the resulting deterioration in quality of life helped prompt Dr Moustafa Bensafi and colleagues with the help of EU research funding to seek ways to restore a sense of smell in people who have lost it.

'People who lose their sense of smell can become depressed,' said Bensafi, a researcher at the Lyon Neuroscience Research Centre in France. 'They have a reduced perception of their food. They stop recognising environmental dangers such as the risk of fire or spoiled food. They also have problems with their social life.'

His research project aims to build a piece of equipment that would help people regain the ability both to detect and to recognise some odours.

Called [Rose](#), the four-year project runs through August 2025. By the end, the researchers hope to show the feasibility of the planned equipment, which they call an olfactory prosthesis.

Initially, it will be restricted to the laboratory because some parts will need to be miniaturised. But ultimately Bensafi aims for a device that people can wear whenever they want to detect odours and that can be easily put on and taken off.

Brain stimulation

A total loss of smell is known as anosmia and a partial loss as hyposmia.

While they know the causes of both conditions, researchers in the field are trying to understand what parts of the brain need be stimulated to help people regain their sense of smell.

‘The scientific maturity of this topic is extremely low,’ said Bensafi. ‘We don’t know how to stimulate the brain.’

One option that the Rose researchers are exploring is direct: stimulating the olfactory system.

A second option is indirect: stimulating a nerve in the head – the trigeminal nerve – that provides sensations of temperature, pain and touch rather than of smell itself.

Because anosmia and hyposmia tend to leave the trigeminal nerve unaffected, the idea is to stimulate the nerve to make people with either condition associate certain foods and objects with the senses they provide.

Food freshness

Take the sensation of freshness in sweet minty food.

Eating a sweet minty food such as a breath mint produces not just a sweet taste and minty smell but also a sensation of freshness, which comes from the trigeminal system.

The prosthesis would include sensors that collect chemical information from foods or other things – for example a molecule from a cake and a molecule from a rose. They would be tested at separate times rather than simultaneously.

The molecules would interact with the prosthesis’s sensors, producing bioelectrical signals that could be sent to the trigeminal nerve in cases where the olfactory system is unresponsive.

Stimulating the nerve would trigger a trigeminal sensation rather than an actual smell, allowing people to perceive their chemical environment and differentiate between the smells of a cake and a rose.

By learning associations between different molecules and trigeminal sensations, people would be able to develop a whole new method – an “olfactory alphabet” – to understand the smells in their surroundings.

So far, the researchers have no plan to commercialise the planned prosthesis as they focus on demonstrating its workability.

Test kit

While Bensafi’s team works to restore smell in people who have lost it, other researchers are focused on training the general population to take better care of their olfactory powers in the first place.

‘If you go to a shopping centre or down the street, you see a place for hearing care and eye care,’ said Marianna Obrist, a professor of multisensory interfaces at University College London in the UK. ‘But where is olfactory care?’

Obrist led a separate EU-funded project that developed a kit for testing the sense of smell. Called [SmellHealth](#), the project ran for a year and a half through November 2022.

SmellHealth developed an olfactory test kit. © OWidgets Ltd, 2022/2023

SmellHealth developed an olfactory test kit. © OWidgets Ltd, 2022/2023

The kit includes a device that delivers smells to the nose and an app that enables users digitally to record their ability to detect different scents.

The app collects data from its users, creating a digital record of smell perception over time.

Wider indicator

Variations in olfactory sensitivity can also be indicators of underlying health conditions.

Studies have shown that patients with diseases such as Parkinson's or Alzheimer's also face a decline in smelling ability. Having a way to measure it could help in the early diagnoses of illnesses.

'Smell perception is associated with neurodegenerative diseases, but also with depression and anxiety,' said Obrist. 'If you start to keep a record of your olfactory performance, you'll start to have data. And we all know that there's power in data for prediction.'

She wants to carry out more clinical trials with the device to highlight its benefits. The ideal scenario would be for the device to be integrated into routine check-ups of patients by their general practitioners, according to Obrist.

Years after his realisation in a Greek orange field in 2014 that he had lost his sense of smell, Tawil regained it following surgery and the removal of nasal polyps.

Other people who lose their sense of smell aren't as lucky as Tawil. For them and for those who wish to take care of their olfactory system, the planned smell prosthesis and the testing kit should ensure they can keep enjoying the sweet and tangy scent of a ripe orange.

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