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“Smell is a potent wizard that transports you across thousands of miles and all the years you have lived,” said deafblind American author and disability rights activist Helen Keller.Does our sense of smell also have power to sniff out sickness? Should doctors use their nose to help them diagnose?Hippocrates, the father of modern medicine, was doing just that, back in 400BC. Today, hounds, exceptional humans, and specially designed electronic noses are using smell to diagnose disease and, sometimes, even to warn of impending death.

Hippocrates sniffs out ailments

“Those urines that are most indicative of death are smelly, watery, black and thick,” wrote Hippocrates. In the ancient art of Traditional Chinese Medicine, urine smelling of rotten apples helped diagnose diabetes.

Confusion came when smells were thought to *carry* disease, rather than simply signal it: in Victorian Britain [6], the wind was more feared than the water (where cholera lurked). During the mysterious ‘Great Stink’ in Paris, in 1880, when a foul odour enveloped the city, people were in panic, envisioning an epidemic (which never came). It was not until the advent of Louis Pasteur’s famous ‘Germ Theory [7]’ (in which specific germs cause particular diseases), that fears were allayed and Parisians accepted that “*tout ce qui pue ne tue pas, et tout ce qui tue ne pue pas*” (“not everything that stinks kills, and not everything that kills stinks”).

Today’s doctors use smell to help detect disease, with GP Dr Bridget Osborne describing her ‘nose for trouble [8]’ which can sniff out, in a patient’s breath, bowel obstruction through a smell of vomit or faeces; complications of diabetes [9] through a fruity fragrance; and liver disease through something known as foetor hepaticus [10], a sweet and musty smell both on the breath and in the urine. “Once smelt, never forgotten” is melena, the prettily-named, offensive smelling, black-tarry stool produced when you are bleeding in the upper part of your intestine. The smell lingers long, aiding diagnosis.

Can cats and dogs smell disease?

“Dogs can be trained to distinguish patients with bladder cancer on the basis of urine odour more successfully than would be expected by chance alone,” states a twenty-year-old study in the British Medical Journal [11]. Six dogs correctly selected urine from patients with bladder cancer on 22 out of 54 occasions, giving a success rate of 41%, almost three times higher than would be expected by chance alone.

“The hypothesis that dogs may be able to detect malignant tumours on the basis of odour was first put forward by Williams and Pembroke in a letter to the *Lancet in* 1989,” write the authors of the 2004 study. “Their thinking arose from a consultation with a woman who claimed to have sought medical help as a direct result of her dog's inordinate interest in a skin lesion, which subsequently proved to be a malignant melanoma.” The dog had continuously sniffed at the suspicious spot, before trying to bite it off one day, proving he really is man’s (and woman’s) best friend.

Not to be outdone, Oscar the Cat [12] hit the medical headlines in 2007. Adopted by a nursing home in Rhode Island, he would make his own ward rounds, choosing a bed to curl up on. Almost invariably, that patient would die in the next few hours. What was Oscar smelling as he predicted 50 deaths?

Diagnosing Parkinson's by smell with the human nose

Joy Milne, a retired nurse, noticed a ‘musky’ smell on her husband six years before he was diagnosed with Parkinson’s. Asked to smell t-shirts from a group of people with and without the disease, she identified a now scientifically-recognised signature smell. Remarkably, she ‘sniffed out’ Parkinson’s [13] on one t-shirt owned by a person who was not diagnosed with the disease until months later.

The unique aroma that Joy was smelling arises from chemical changes in skin oil triggered by the condition; skin swabs have shown 500 compounds unique to people with Parkinson’s, and these could help diagnose the condition earlier and monitor whether treatments are working.

Amazingly, we humans without hypersensitive noses can sometimes spot sickness through smell, and this might have survival advantages, acting as an early warning sign, allowing you to limit contact with the poorly person (unless you’re caring for them) and avoid infection. In one experiment [14], body odour samples and photographs were taken from mildly sick people and healthy controls: when ‘healthy’ faces were paired with ‘sick’ body odours, the faces were ‘liked less’ (according to the researchers). It’s a bit like sniffing out spoiled food, and avoiding it, to escape food poisoning – but an etiquette minefield.

In his book “The Body”, Bill Bryson writes that smell is the sense that nearly everyone says they would give up if they had to give up one – and many young people would sacrifice smell rather than part with a favoured electronic device. “That would be a little foolish,” he writes.

Harnessing an electronic nose

Sometimes, “the nose knows not [15]”, when it comes to diagnosing disease, and in one infectious disease journal, doctors penned a letter with exactly this title to explain how nurses were not always as accurate as they thought when sniffing out bacteria that causes serious diarrhoea. “Does the smell really tell [16]?” is a question commonly asked when strong-smelling urine is used as a symptom of urine infection – it’s sometimes a red herring.

Dr Daniel Chan and his team at the Mayo Clinic are hoping to extend our ability to smell through trialling an “electronic nose [17]” to sniff out Barrett’s oesophagus, which often develops into cancer. Using an array of sensors, these devices detect ‘smell fingerprints’ of different diseases, including kidney disease, diabetes, lung cancer, arthritis and asthma.

Biomimicry [18] is a practice that learns from and mimics the strategies found in nature to solve human problems, and find hope. Artificial noses are a nature-inspired invention, and if the nose, the so-called ‘Cinderella’ of the sense organs, can motivate such progress in medicine, what other solutions does nature hold hidden? Scientist Alexander Graham Bell pointed to such promise back in 1914. “If you are ambitious to found a new science, measure a smell,” he said, and he was right.



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