Letter to the Editor

Title: Electronic nose v Canine nose: Clash of the Titans

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We read with great interest the article by Sonoda et al published on line (*Gut* doi:10.1136/gut.2010.218305) of canine scent detection in those with colorectal cancer. The concept of using a dog to detect diseases is not new; there are many reported incidents of dogs barking at their owners (or even trying to bite the leg off of an owner with melanoma!) who are later shown to have the disease.

Several studies have shown that dogs are able to detect, amongst others, breath, lung, bladder, ovary, prostate and skin cancers. In these reports the dog is trained to recognise the disease state (in fact the dog is reminded of these different groups usually the morning of the experiment). It is also important to recognise that the dog achieves this separation even within the 'multi-odour' hospital environment, unlike modern sophisticated instrumentation such as GC/MS. An important part of this work is the relationship between the handler and the dog, but, a notable question is why the handler (or doctor) is not sniffing the sample themselves? Though the dog out performs humans in terms of chemical detection limit and sensitivity, the human nose is still a power 'sniffing' tool. Dogs have ~ 200 million olfactory receptors (or more than 800 different types) with up to 6% of their genome devoted to olfactory receptors (1) compared with humans ~ 5 million and up to 2% of the genome – where olfactory receptors are still the largest single family within the human genome (2).

If we consider the history of medicine, it is only recently that "sniffing" or even tasting bodily output of a patient has fallen into miss-use. There are reports that the ancient Chinese used sniffing as part of the diagnosis process. In medieval times, doctors believed that the colour, smell and taste of a patient's urine was important (for example sweetness to identify diabetes). In Victorian times, medical training included instructions to students on how to interpret the sights, sounds, feel and even smell of disease. Even today, through discussions with nurses, they are able to identify disease through smell (e.g. *Clostridium Difficille*), well before microbiology toxin results are available. <u>One limitation of course is that dogs like humans undergo 'olfaction fatigue' where olfactory receptors become saturated with a particular odour hence sensitivity is lost with continuous exposure.</u>

<u>Thus perhaps an alternative modern approach is required encompassing robotic olfaction. The "Electronic Nose" is an attempt to create such technology.</u> It is an instrument that attempts to replicate the human olfactory system. Here, arrays (normally 32 or less) of chemical sensors are used with each sensor being in some way different. Thus, the interaction between the sample and the sensor is unique for every sensor. This generates a pattern of responses that is

described as the “smell fingerprint” of a sample. A model is then built that learns these fingerprints and when exposed once more they recognise and identify the smell. Medical Olfactory systems have been adapted for detection of lung cancer, schizophrenia and wound infections (3). Similarly, we have shown its utility to distinguish between gastrointestinal and metabolic disease groups (4) – all based on profiling volatile organic compounds (VOCs). Thus the technology is available and has practical clinical utility. Should we therefore replace mammalian scent detection with a machine or return to teaching physicians to sniff?

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