Cyber sensor 'nose' how to judge

Australia's winemakers and viticulturists aiming for a more consistent supply of premium quality grapes may soon have a scientific 'super sniffer' at their disposal – the Cybernose.

Chris Herden

WINEMAKING IS AN astute and ancient craft and there is much folklore attributed to its masters; those gifted gurus of the grape who, with a sniff, a swill and a dose of intense scrutiny, can determine what makes a great wine.

They also apply a combination of sensory and analytical examinations in an attempt to judiciously determine if a grape has the characteristics necessary to deliver an inspiring creation.

These artisans are, however, only human and although they can specify exactly what is needed from a grape, they are vulnerable to human flaws and environmental factors which challenge their consistency in the detection of taints and off-notes.

The winemaker's need to acquire an objective measurement of wine aroma and flavour, in order to streamline the production process and make it less expensive, has become even more critical in recent years as Australia's multi-billion dollar wine export trade faces stiffening competition from global producers.

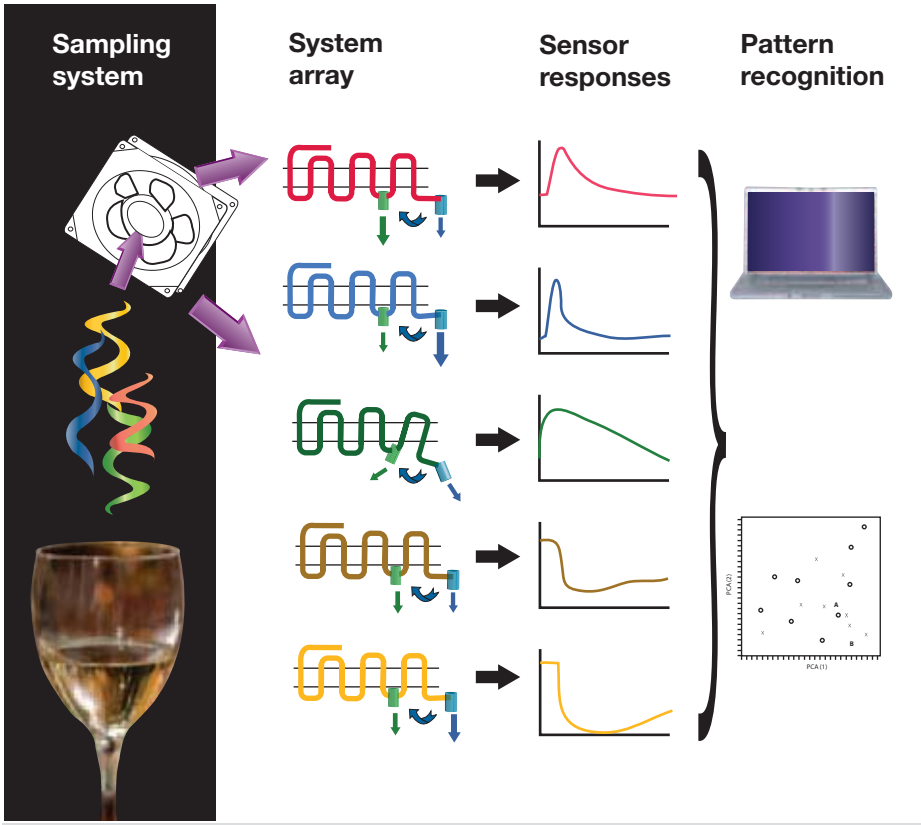
Though no existing technology can provide objective measures of aroma in real time, the CSIRO may have the answer to what will help the industry measure and control flavour components of wine.

"We have developed a new and highly sensitive transduction technology that allows olfactory receptors to talk to a machine," explains Dr Stephen Trowell, entomologist and leader of the CSIRO Food Futures Flagship Cybernose Project.

"This was the key breakthrough necessary to make this technology a reality. We believe it will aid winemakers through the whole production process and it may play a part in establishing a closer link between specific consumer preferences, all the way back through the winemaking and viticultural chain," Trowell said.

He says surpassing the sensory capabilities of the human nose is not the aim of the Cybernose.

"Simply matching them would be a magnificent achievement. The point is not so much to surpass a human's olfactory capabilities but, rather, to surpass the instrumentation that is commercially available now," he said.



This is a general schematic of how the Cybernose would work.

However, one significant advantage of an instrument is that it is objective, offering a consistent response 24/7."

The Cybernose project, which began in 2004 and has since been awarded substantial Federal Government funding, is an ambitious quest to develop the world's first bionic nose.

The project has made a lot of progress in understanding what the receptors of insects and worms respond to and this has enabled the build-up of a large library of 'smell' receptors, from which engineers can select sensors for any particular task.

"We aim to have performance as good as a mammal's nose in terms of sensitivity and discrimination within the group of target samples," he said.

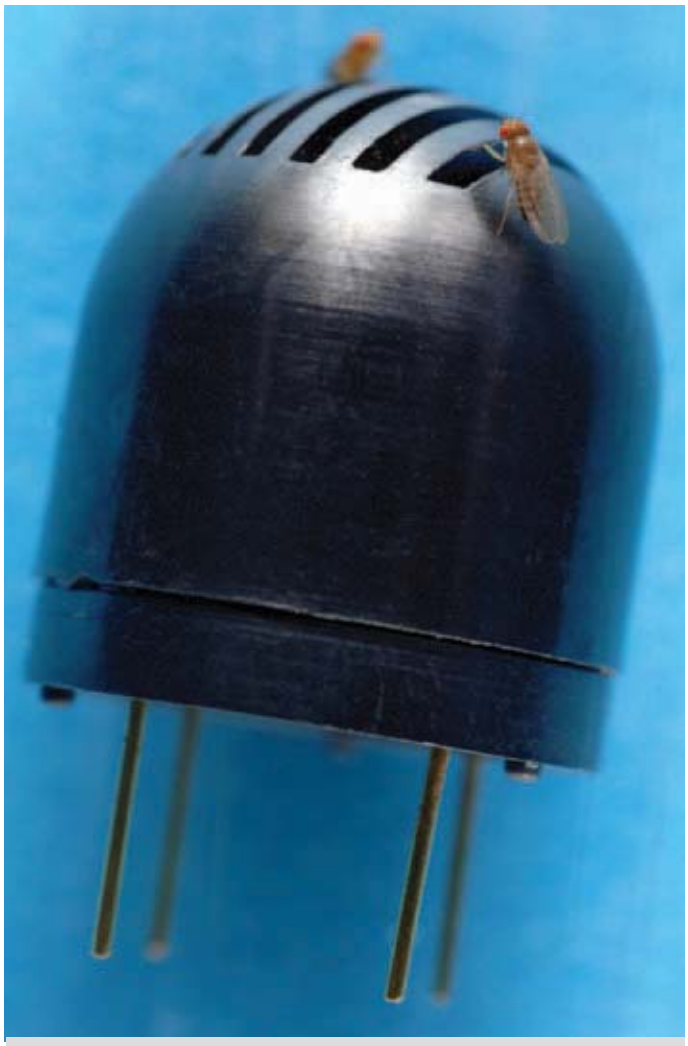
"By this I mean that there might be a Cybernose tuned for detecting explosives, a different version tuned for detecting disease markers in expired breath and another tuned for monitoring wine character."

The senses of smell and taste in many animals surpass the sensitivity capabilities of technical apparatus while disregarding the interferences of the surrounding environment. For example, dogs can proficiently distinguish the odours characteristic of bladder cancer and insects can be trained to detect explosive residues.

Joint research undertaken by the CSIRO Food Futures Flagship and Monash University identified a number of receptors from the vinegar fly (*drosophila melanogaster*) that respond to compounds important for wine sensory quality. The vinegar fly is strongly attracted to the odour of fermenting fruit and is a well-characterised model for olfactory research.

On examination, the fly's olfactory receptors showed great promise as a tool for detecting specific taints and the fingerprints of complex wine aromas.

Parallel research funded by the Grape and Wine Research and Development Corporation led to a new understanding



This is a Drosophila vinegar fly, which has thousands of olfactory receptors and can process the smell of fermenting grapes in real time and track them to their source, sitting on a single conventional electronic nose sensor. The CSIRO aims to replace the latter with elements from the former. Photo: Carl Davies.

of what chemicals in winegrapes are important for aroma potential.

Experimental models of the core Cybernose technology for biosecurity applications and the detection of explosive materials are being integrated into a working benchtop prototype, which will be demonstrated to the Department of Defence in late 2013.

"At the moment, it is a series of sub-systems sitting on a table and linked by tubes and wires. Eventually, we would like it to be something portable and compact," he said.

"Our intention, once the major technical hurdles have been overcome for security and defence, will be to adapt the technology for health and food applications, including the wine industry."

The Food Futures Flagship biosensor research has the potential to boost the value of domestic and export wine sales and optimise grapegrowing resources. For wine production, it would be necessary to train Cybernose using samples previously classified by humans, whether experts or a consumer panel. The opportunities for the Australian wine industry to develop new products based on consumer preferences are unlimited.

"And, with some good marketing, it could be used to tailor and then promote wines to new and developing markets," Trowell said. "But I am getting well outside my area of expertise here." GW