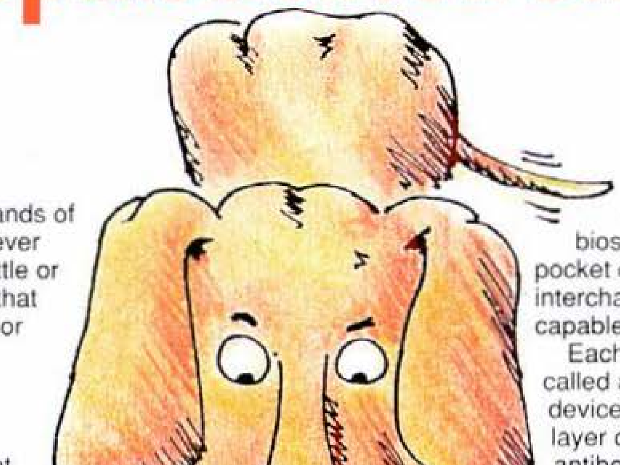
Illustration: Brian Gosnell

A sophisticated sniffer



If you're among the tens of thousands of Australians who suffer from hay fever brought on by the flowering of wattle or privet, you may laugh at the idea that trees are to blame for humans' poor sense of smell.

But it's true nonetheless. Our tree-dwelling primate ancestors needed binocular vision — and brains complex enough to interpret what their eyes were telling them — if they were to survive the risks of leaping from branch to branch. Evolution thus favoured eyes facing forward (which limited the size and complexity of noses) and bigger brains employing obsolete olfactory lobes for processing information. Millions of years later, the result is good stereoscopic vision, good problem-solving brains... and a sense of smell the laughing stock of the animal world.

In fact, we have such a poor sense of smell (although our brains are so adept at solving such problems) that we employ other species to do our sniffing for us: canaries to detect toxic gases in coal mines and police dogs (whose sense of smell is several hundred times more sensitive than our own) to detect drugs or explosives.

At the CSIRO Division of Applied Physics in Sydney, project leader Dr Tony Collings brought together a team of more than 20 scientists from six of the Organisation's Divisions to develop a new generation of biosensors so sophisticated that they are more efficient than many animals' noses.

The team — with experts in thin films, ultrasonics and electrical physics (from the Division of Applied Physics), surface chemistry (Division of Chemicals and Polymers) and receptors, immunology and biochemistry (Divisions of Animal Health, Food Processing and Plant Industry) — is aiming at developing a battery-powered biosensor, about the size of a pocket calculator, that includes an interchangeable 2·5-cm-square wafer capable of detecting nominated odours.

Each wafer is an ultrasonic detector, called a SAW (surface acoustic wave) device, coated with a monomolecular layer of specific monoclonal antibodies: because these respond to the presence of only one chemical, and at concentrations of the order of a few parts per billion, they allow detection and identification of particular chemical compounds.

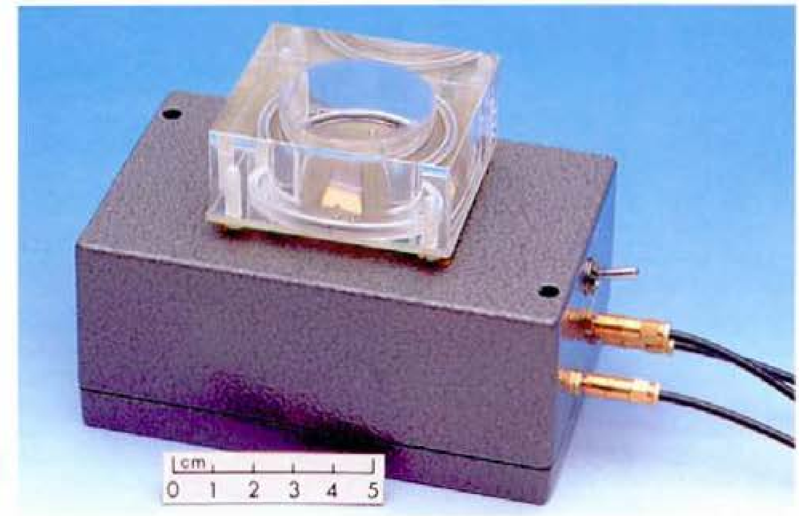
To sniff out odours at low concentrations, an operator will simply insert the right wafer and pass the biosensor over, say, luggage, food containers or various elements of an industrial process that may produce odorous by-products.

The Division of Biomolecular Engineering will be involved in developing techniques to produce monoclonal antibodies at a commercial scale, since the predicted market for biosensors is world-wide. The initial aim of the project is to come up with biosensors to detect contaminants such as: phomopsin, a toxin produced by fungi in lupins (of particular value to Australia's $150 million a year lupin-seed export industry); trichloroanisoles, chemicals associated with the odour of moulds; or insecticide and herbicide residues in the environment.

The team is also looking at biosensors to measure amounts of sweeteners such as saccharin and thaumatin in food, and to detect offensive *para*-cresol from piggery waste.

Biosensors also have great potential in the early detection of hydrogen sulfide in the petrochemical industry or in sewage-treatment works, in waste management and in the detection of a variety of pollutants and other dangerous substances.

Carson Creagh



A prototype surface acoustic wave sensor. The container on top holds a liquid solution for testing.