

They've got it licked

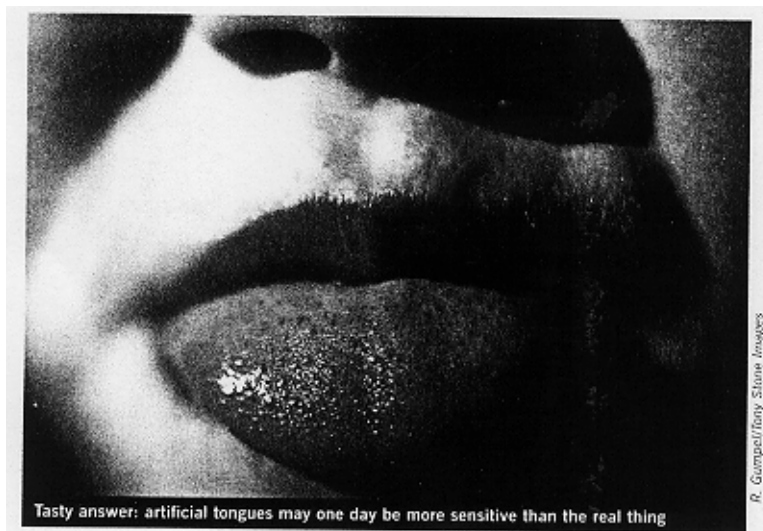
Artificial sensors can taste what's in a complex mixture

ELECTRONIC "tongues" could soon be used to monitor the quality control of bottled mineral water. The devices could also sample complex solutions such as blood or urine.

The human tongue can distinguish between a dazzling array of subtle flavours using a combination of just four elements of taste: sweet, sour, salt and bitter. Each element is detected by one of the four types of taste bud located on the tongue. Now researchers at the University of Texas in Austin have designed an electronic tongue

The sensors responded to different combinations of the four artificial taste elements with unique combinations of red, green and blue, enabling the device to analyse for several different chemical components simultaneously.

Eric Anslyn, a chemist at the university, hopes ultimately to make a device "even more sensitive than the human tongue". For now, his device has only nine wells on a half-centimetre wafer, but he says current technology allows more than 100 wells in the same area. The researchers plan to



that works along the same lines (*Journal of the American Chemical Society*, vol 120, p 6429).

Using chemical sensors, they have demonstrated that the electronic tongue can "taste" different solutions. The team attached four well-known chemical sensors to minute beads made of polyethylene glycol and polystyrene. The beads were placed in micro-machined wells on a silicon wafer.

The sensors respond to chemical stimuli by changing colour, so the wafer was placed between a light source and an image sensor. The responses were monitored as red, green and blue light channels from each well. The first device they built was designed to detect calcium and cerium ions, acidity and the simple sugars. Each sensor responded differently to the various conditions: for example, one turned yellow in response to high acidity, red if cerium ions were present, and purple under basic conditions.

replace the numerous tests carried out on a blood sample with a single test.

The electronic tongue could monitor the quality of simple solutions, says John Warburton, a director of Neotronics Scientific, an Essex-based company that manufactures electronic noses. Such instruments detect volatile compounds that evaporate from a solution to give an odour. "A good application would be something like mineral water, where you are trying to sell a product that should have no taste or a very simple taste," says Warburton.

He points out that some of our sensation of taste comes from our sense of smell. The electronic nose and tongue could work together, he suggests, to analyse compounds in solution as well as those that evaporate. "For a certain type of material, there's probably a great deal of synergy between the two," he says. **William Wood and Lila Guterman**