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UT scientists engineer a tiny arbiter of taste

- Electronic tongue could test food for likely popularity and blood for cholesterol

By Dick Stanley
American-Statesman Staff

Remember the New Coke debacle? The hired tasters loved it. But few others did, and the old formula was hastily resurrected as Classic Coke.

With the new electronic tongue, under development by University of Texas chemists and electrical engineers, New Coke might have been licked much sooner.

The device, consisting of hundreds of chemical microsensors on a silicon wafer to mimic the taste buds of a human tongue, has a multitude of potential uses. Among them is the rapid testing of new food and drink products for comparison with a computer library of tastes that people are known to like.

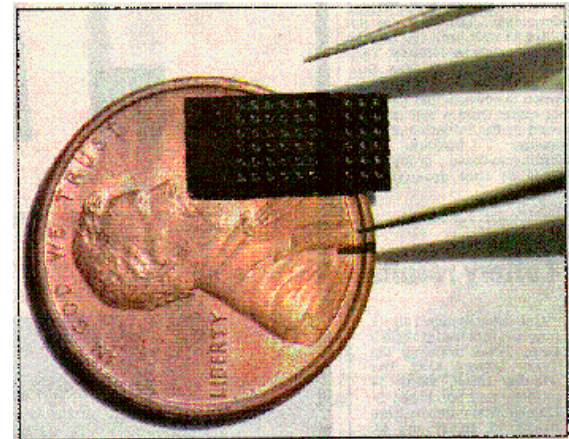
But the UT tongue, which is smaller than Abraham Lincoln on the head of a penny, could boldly go where few tongues have gone before.

"If you could taste blood," said Eric Anslyn, a UT chemist and tongue researcher, "you could taste for cholesterol."

Or cocaine in urine, toxins or microbes in water, or familiar and unfamiliar chemicals in any liquid: palatable, icky or plain poisonous. The National Institutes of Health, for example, recently gave the UT researchers \$600,000 to develop a version of the tongue to try to replace the multiple standard medical tests done on blood and urine with one rapid test.

The UT research, which was reported in a recent edition of the Journal of the American Chemical Society, began in 1996 when electrical and computer engineer Dean Neikirk and chemists John McDevitt and Jason Shear began kicking the idea around.

They'd read of research in Britain and Sweden to try to make biosensors that could mimic



Tom Lankes/AA-S

The electronic tongue developed by UT chemists and engineers is made up of hundreds of chemical microsensors. The device is expected to have a host of practical and commercial uses; it might even work on brewing beer.

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UT tongue may hook up with electronic nose

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the sophistication of a nose. Dog noses, for example, are so sensitive they can sniff out particular molecules in vapor concentrations as low as a few thousand parts per billion of air.

Technologies for the detection and analysis of vapor and liquid molecules exist, but they tend to be bulky, slow and complicated, and able to assay only one or a few chemicals at a time. To fully mimic a nose or a tongue, a bio-sensor should be able to rapidly assay many samples at once.

"We put a nose together first," Neikirk said, "to sniff out iodine."

"But many chemicals cannot be (evaporated)," McDevitt said. "So you need a tongue."

"That's when they brought me in," Anslyn said.

Anslyn had some polymer microbeads, each one smaller than the width of a hair, which biochemists use to synthesize DNA and its proteins. The researchers figured the beads would work well in an electronic tongue.

Mimicking the surface of the human tongue, with its thousands of tiny cavities containing various

chemical receptors for the four main classes of taste buds (sweet, sour, salt and bitter), the UT researchers micromachined inverted pyramids into silicon wafers and dropped a single polymer bead into each one. Each bead was equipped with a sensor for a particular class of chemicals.

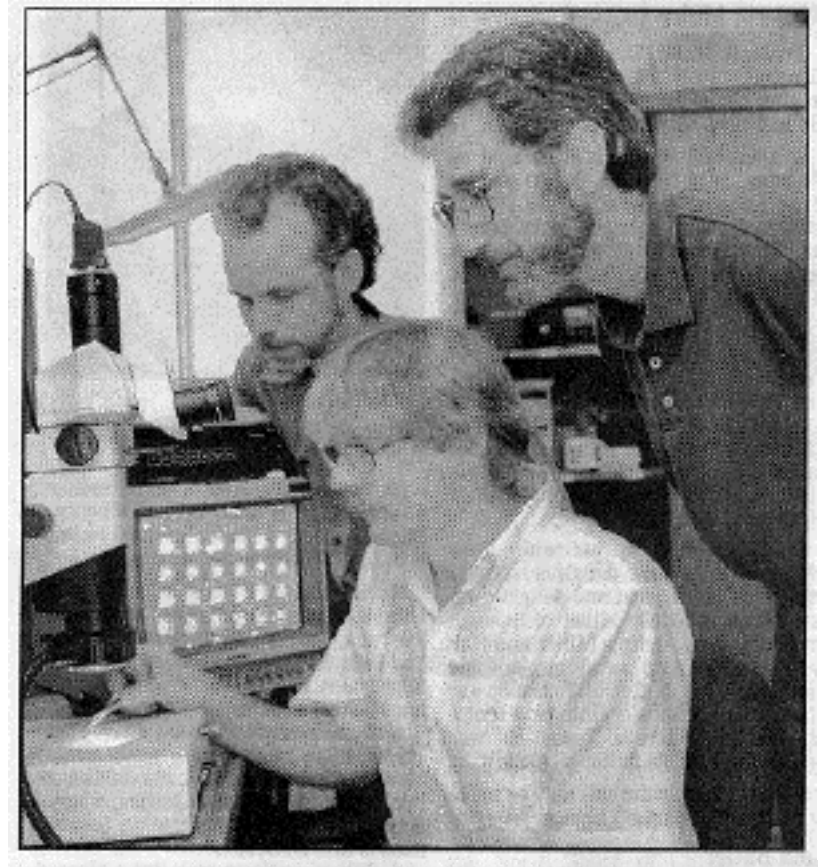
Then they attached the sensors, which respond to chemicals by changing color, to a camera-on-a-chip to analyze the color changes at 30 frames a second and report them to a computer.

They're now up to hundreds of bead sensors on a single wafer, with the potential to rapidly analyze millions of chemical combinations. But they're not satisfied with just a tongue on silicon.

"We're working on a process to make them cheaply and quickly," Neikirk said. "They could come on a roll of tape, for example, to be used once and thrown away."

In nature, of course, the sensation of taste is related to the sense of smell. Noses and tongues work together.

"There's probably a good deal of synergy between the two," John Warburton, director of a British company that makes electronic



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UT chemists Eric Anslyn, left, and John McDevitt, seated, and UT computer engineer Dean Neikirk work with their electronic tongue under a microscope; its image is reflected on the screen.

noses, told New Scientist magazine last week in an article on the UT tongue.

Indeed, McDevitt said the electronic nose and tongue might collaborate, say, in the brewing of beer: The nose could sense the vapors while the tongue

monitored the liquid in the vat.

While the UT researchers prepare to file for patents on their electronic tongue, many food and drink processing companies are already calling.

"About one a day," McDevitt said.