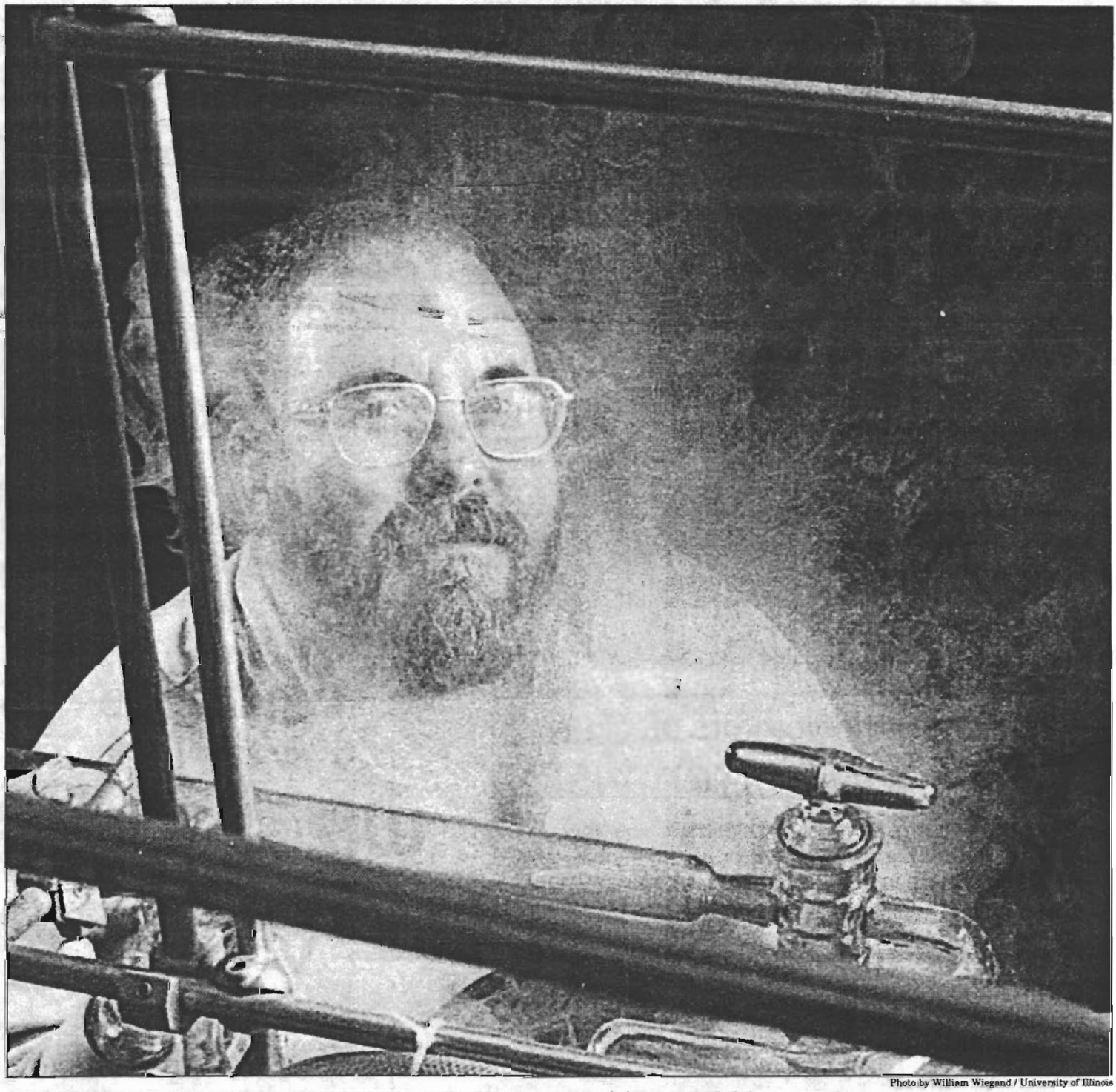
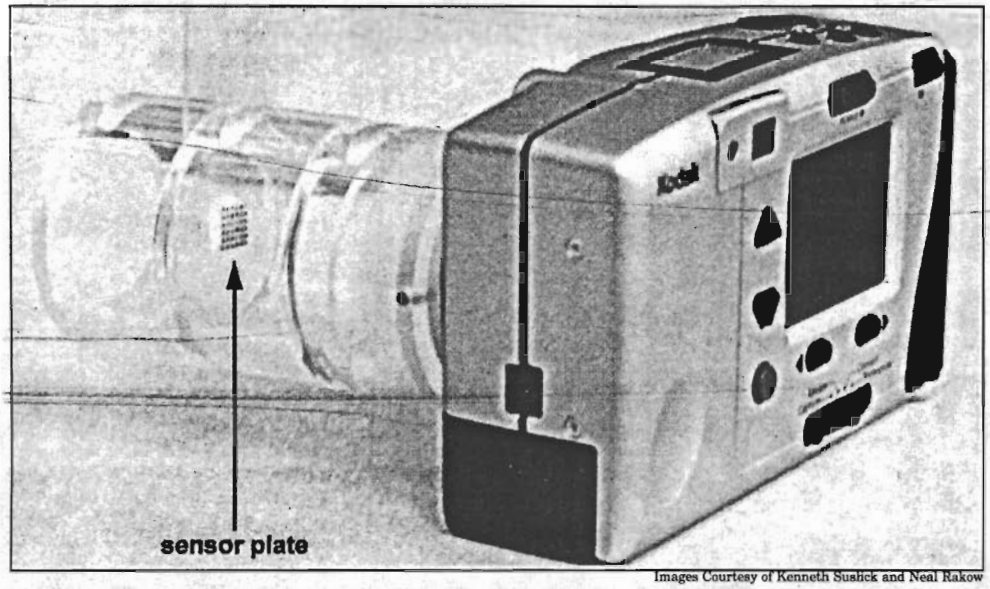


Photo by William Wiegand / University of Illinois

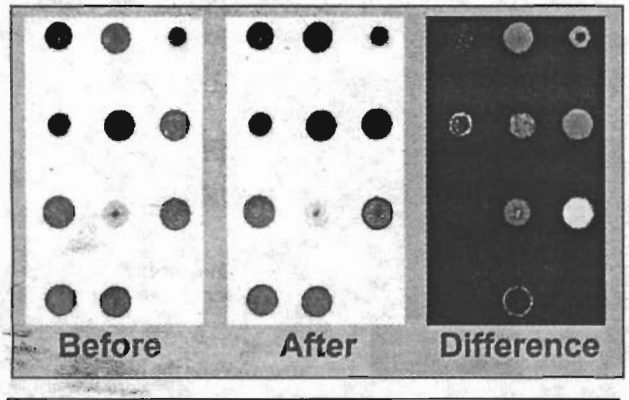
Kenneth Suslick, of the University of Illinois at Urbana-Champaign, in a haze of nitrogen gas, an odorless component of air.

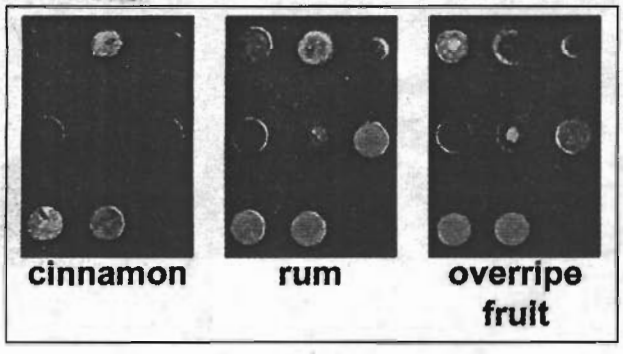
Low-tech sensor could be used to detect chemical fingerprints ranging from bioweapons to spoiled food

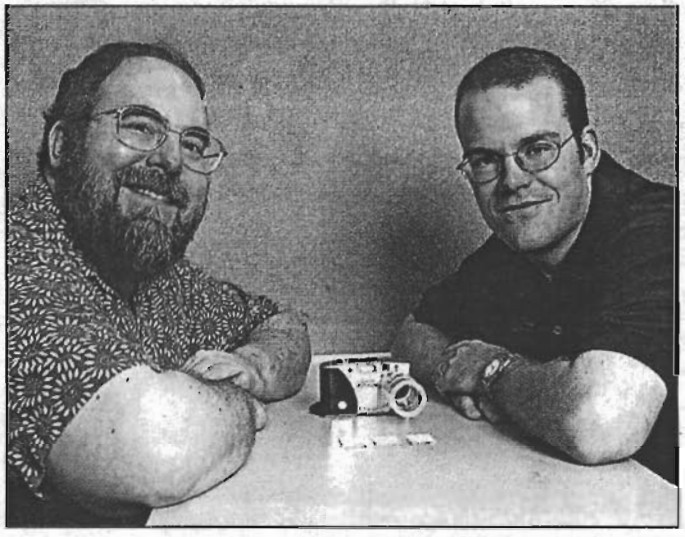
The Artificial



Images Courtesy of Kenneth Suslick and Neal Rakow







Clockwise from top: The "smell-seeing" camera, developed by chemists Kenneth Suslick, above at left, and Neal Rakow at the University of Illinois, uses reactive dyes called metalloporphyrins to produce color patterns according to the chemical molecules in the air.

Sniffer

By Catherine Zandonella
STAFF WRITER

THE HUMAN NOSE is a many-splendored thing, but can its function be replaced by a strip of paper?

Kenneth Suslick, a chemist at the University of Illinois at Urbana-Champaign, thinks so. He created an "artificial nose" that could be used to detect hazardous chemical leaks, sniff out biological weapons, or even tell you if your lunch meat has gone bad.

Suslick's artificial nose looks like a strip of paper covered with colored dots, and it can be as small as the size of a dime.

When exposed to an odor, the colored dots change color in a pattern unique to each smell.

Suslick calls the system "smell-seeing," because the device causes a smell to be converted into a visible signal.

"It is so simple, and that is one of the most delightful things about it," said Suslick, who invented the gadget with his graduate student, Neal Rakow.

Artificial noses are a hot research topic. A lightweight, portable sensor could detect dangerous odors in places too small for a person to crawl or alert U.S. military personnel to biological weapons.

Suslick's device is inexpensive, simple to make, and doesn't require extra equipment or batteries. It is "delightfully low-tech," he said.

AMONG THE SCENTS Suslick's sensor can detect: the nose-tickling aroma of cinnamon and the deadly smell of chlorine gas.

A smell, whether it be Calvin Klein's latest perfume or the stench emanating from the strange, brown fuzzy thing in the back of the fridge, is simply made up of one or more chemical gases floating about in the air.

These gases can chemically react with various dyes on Suslick's smell detector.

The dyes are composed of doughnut-shaped, metal-containing molecules known as metalloporphyrins. When a smell molecule encounters the sensor, it gets stuck in the doughnut hole, setting off a chemical reaction that causes a color change.

Suslick arranged different metalloporphyrin dyes into a grid or array. In as little as 30 seconds, each smell will create a distinct color pattern on the grid.

The pattern can then be read by the human eye, or for a more sensitive approach, by a digital camera that records the color intensity of each dye and figures out which smell it is and how much of it.

The smell sensor is sensitive enough to detect down to the level of 35 parts per billion, which means it can detect 35 smell molecules floating around for every 1 billion molecules of air.

This is as sensitive as the human nose, and is on par with many of the more sophisticated, and more expensive, artificial noses in development, said Suslick.

Just about every kind of chemical will react with Suslick's arrays.

"You will get a color change for pretty much any smell as long as it is at a high enough concentration," said Suslick.

The things that smell the worst cause the greatest color change, he said.

Suslick said the sensor was inspired by the human body. Metalloporphyrin-like molecules are circulating inside each of us. In the blood these are known as hemoglobins, the molecules that shuttle oxygen around. When carrying oxygen molecules, hemoglobin turns a full-blooded scarlet color. When the oxygen molecules depart, the hemoglobin turns a purplish blue.

A lightweight, inexpensive and disposable sensor like Suslick's could be worn as a badge by soldiers to detect exposure to biological and chemical weapons, said Richard Crooks, a chemist at Texas A&M University who is developing chemical sensor arrays with collaborators at Sandia National Laboratories in New Mexico.

Currently such sensors weigh several pounds and need heavy battery packs to run them, said Dickson.

Suslick's sensor could also be used to protect against deadly food-borne diseases like salmonella. "If you can come up with a clever way of detecting something like salmonella for not too much money," said Crooks, "you could imagine slapping one of these sensors on every package of chicken sold."

The device is also resistant to water vapor, which can clog other types of smell sensors.

Suslick is now working on figuring out the color pattern for the essence of burnt popcorn. He wants to build a detector that could be installed in a microwave oven to activate an automatic shut-off device. "Imagine never burning another bag of microwave popcorn again," said Suslick.

Now that is progress.

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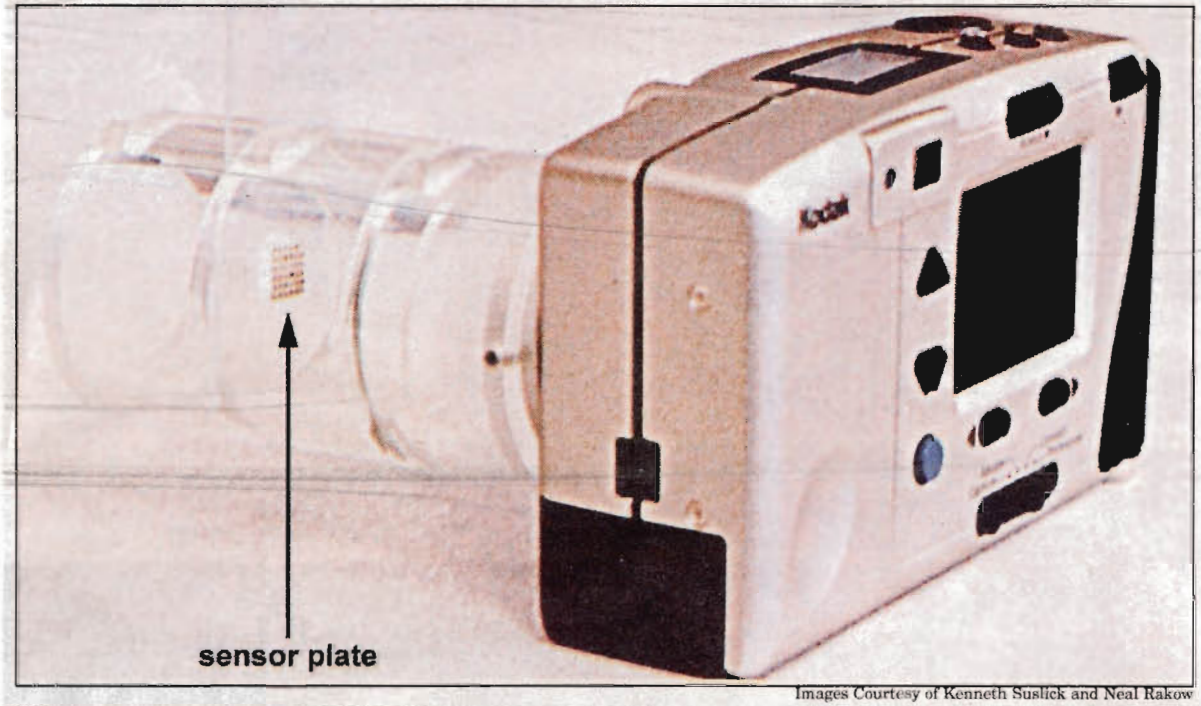

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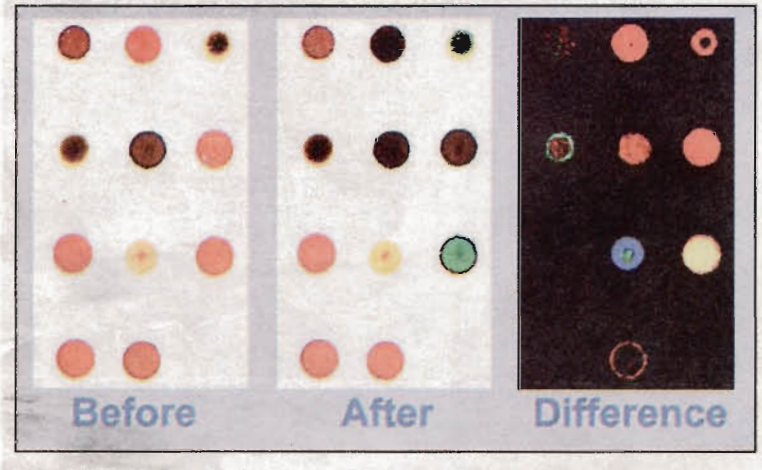

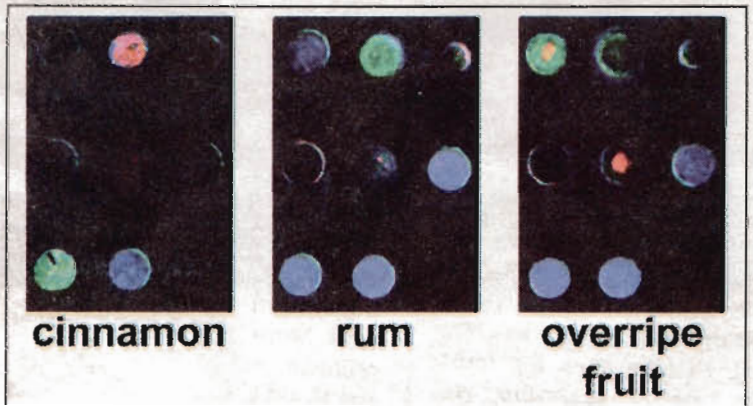

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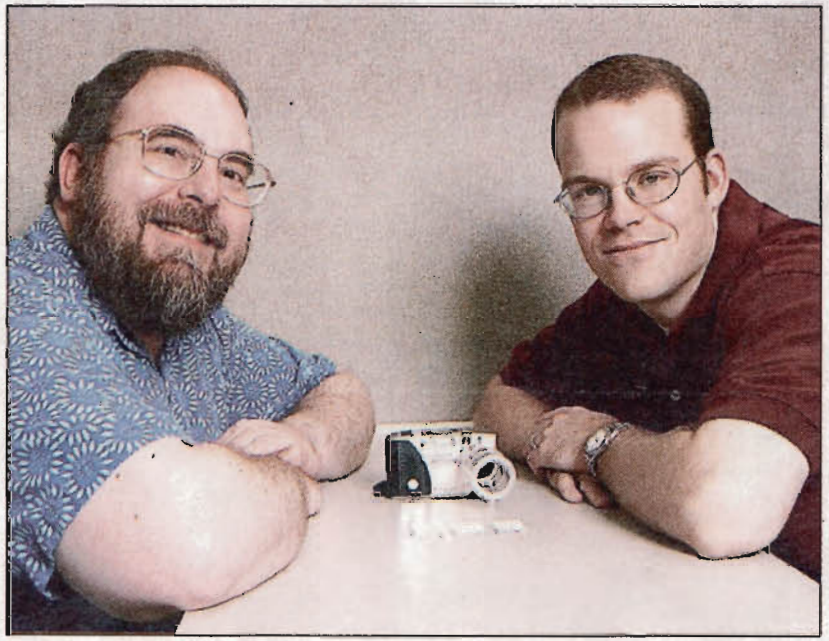

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