



## Artificial nose knows

Simple and inexpensive, artificial nose senses smell by seeing colors



photo by Bill Wiegand

**Seeing odors** UI chemists Kenneth Suslick (pictured) and Neal Rakow have developed an artificial nose that is simple, fast and inexpensive – and works by visualizing odors. The researchers have applied for a patent.

By James E. Kloeppel

News Bureau Staff Writer

Imagine a small slip of paper that can sniff out odors such as sour milk, illegal drugs, environmental pollutants or deadly toxins simply by changing color.

As reported in the Aug. 17 issue of the journal *Nature*, chemists Kenneth Suslick and Neal Rakow at the UI have developed an artificial nose that is simple, fast and inexpensive – and works by visualizing odors.

Called “smell-seeing” by its inventors, the technique is based on color changes that occur in an array of vapor-sensitive dyes known as metalloporphyrins – doughnut-shaped molecules that bind metal atoms. Metalloporphyrins are closely related to hemoglobin (the red pigment in blood) and chlorophyll (the green pigment in plants).

“Our technique is similar to using litmus paper to determine if a solution is acid by seeing if the paper goes from blue to pink,” said Suslick, the William H. and Janet Lycan Professor of Chemistry at the UI. “But we have generalized it so a whole range of chemical prop-

erties are being screened by an array of many different dyes that change color when they interact with different chemicals. The resulting changes in the array provides a color fingerprint unique to each vapor.”

To create an array, the researchers paint a series of tiny dots – each dot is a different dye – on an inert backing such as paper, plastic or glass. The array is then scanned with an ordinary flatbed scanner or an inexpensive electronic camera before and after exposure to an odor-producing substance.

“By subtracting the ‘before’ image from the ‘after’ image, we obtain the color-change pattern of the odorant,” Suslick said. “By comparing that pattern to a library of color fingerprints, we can quickly identify and quantify the chemical compounds present.”

The sensitivity of the arrays outshines that of their human counterparts.

“The human nose is generally sensitive to most compounds at a level of a few parts per million,” Suslick said. “The sensitivity of our artificial nose is 10 to 100 times

### Potential applications of smell-seeing arrays

#### Food and beverage industry:

- detect presence of flavorings, additives or spoilage.

#### Perfume industry:

- identify counterfeit products.

#### Customs checkpoints:

- detect banned plant materials, fruits and vegetables.

#### Chemical workplace:

- detect and monitor poisons or toxins.

better than that for many compounds.”

And, unlike other technologies that are being explored, smell-seeing is not affected by changes in relative humidity.

“Our color-change technique is extremely insensitive to water vapor,” Suslick said. “The ability to easily detect odors regardless of the humidity background is definitely a big advantage.”

The researchers have applied for a patent. Research support came from the National Institutes of Health and the Department of Defense. ♦