



Aimpoint's new player in sighting optics

The Patrol Rifle Optic **Page 34**



Locate latest mapping & navigation tools

Pinpoint 5 digital options **Page 32**

The #1 information source for law enforcement managers

LET LAW ENFORCEMENT TECHNOLOGY

Just say nose

The sensitivity of this artificial nose is said to be 10 to 100 times better than the human nose.

This stamp-sized sniff sensor identifies poisonous gases & chemical toxins almost instantly **Page 18**

Wildfires spark disaster response corps

California frees up first responders with a coordinated deployment plan **Page 10**

Mapping human behavior

How cell tower data, social media geolocation help investigators **Page 24**

OFFICER.com

what's available now (info on Page 6)...

- **Break the Cycle** LEOs battle on the front line of family violence
- **Legendary Lawman Dave Mather** Nicknamed Mysterious Dave for good reason
- **Video:** Take a seat next to the iForce

CYGNUS BUSINESS MEDIA



Just say nose:

New sensor lets police breathe easier

Stamp-sized sniff sensor identifies poisonous gases and chemical toxins almost instantly

By Douglas Page

The police department in the small California community of Hemet has been under siege. Over the first few months of 2010 a series of booby traps were directed at Hemet officers, including a ballistic device strapped to a fence at the gang unit compound that sent a bullet within inches of an officer's face. In another instance, an explosive device was attached to an unmarked police car while the officer was inside a convenience store. During this same period, four city trucks suspiciously caught fire, a gas line was redirected to leak noxious gas into a police building housing an anti-drug task force, and later an arson fire damaged the police building that housed evidence gathered from the earlier attacks, as well as from thousands of pending and closed criminal cases.

Hemet, and other targets of domestic and foreign terrorism, may be a suitable site to deploy a new disposable, postage stamp-sized chemical sensor designed at the University of Illinois Urbana-Champaign. The device sniffs out known poisonous gases and vapors, and displays the results simply by changing colors. It is designed to detect accidental or deliberate release of poisonous gases or toxic industrial chemicals into the environment, or in the case of Hemet, somewhere in the squad room.

While physicists working in the lab wear radiation badges to alert them to radiation present in the workplace, chemists and industrial workers who handle dangerous chemicals do not have

equivalent devices to monitor exposure to potentially toxic chemicals. Likewise, police officers, fire fighters and other first responders are rarely aware of the exact nature of the chemical dangers that lurk in the environments they encounter when responding to emergency calls.

The Illinois technology has obvious law enforcement and homeland protection potential.



The handheld device that houses the array of chemical-detecting pigments is about the size of a deck of cards.

“Currently, police and other first responders have no inexpensive and easily carried detector that can identify a large number of toxic gases, but one can easily imagine having one of these detectors in the glove compartment of every police patrol car and fire truck,” says UIUC chemistry professor Kenneth Suslick, inventor of the new sensor.

Connecting the dots

Suslick refers to the device as an opto-electronic nose that works by visu-

alizing colors, or as he sometimes calls it, “smell seeing.” The human nose is generally sensitive to most compounds at a level of a few parts per million. Suslick says the sensitivity of his artificial nose is 10 to 100 times better than that for many compounds.

Suslick says his colorimetric sensor array of vapor-sensitive dyes is able to identify 20 different toxic gases taken from the International Task Force-45 list of toxic industrial chemicals at concentrations that pose immediate danger to life and health.

“This device is a lightweight, disposable sensor array that changes color when exposed to different chemicals,” Suslick says. The polka-dotted array itself is about the size of a postage stamp, and the entire handheld device that houses the array is about the size of a deck of cards. The dots, or sensors, in the array are actually chemically responsive dyes. Suslick calls the collection a digital, multidimensional extension of litmus paper. The device consists of an array of 36 different nanoporous pigments whose color dyes change depending on their chemical environment.

The array is scanned with an inexpensive electronic camera incorporated in the handheld device before and after exposure to any odor-producing substance. By subtracting the “before” image from the “after” image, the color-change pattern of the odorant is obtained in a matter of seconds. The pattern of the color change is a unique molecular fin-

Images courtesy of Kenneth Suslick

COVER STORY

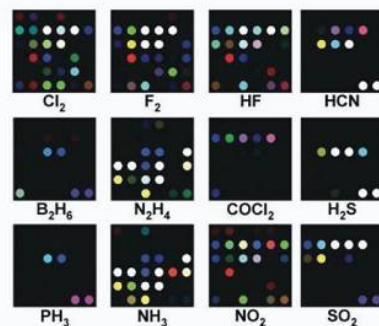
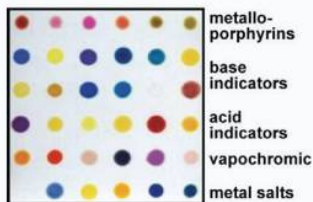
“Police officers, fire fighters, and other first responders are rarely aware of the exact nature of the chemical dangers that lurk in the environments they encounter when responding to emergency calls.”

The sensitivity of this “artificial nose”, created by University of Illinois Urbana-Champaign researchers, is said to be 10 to 100 times better than the human nose for detecting a number of compounds. The device consists of an array of 36 different pigments whose color dyes change depending on their chemical environment. The polka-dotted array itself is no bigger than a postage stamp.

COVER STORY

gerprint for any toxic gas, and also reveals chemical concentration levels. "By comparing that pattern to a library of color fingerprints, we can quickly identify and quantify the chemical compounds present," Suslick says.

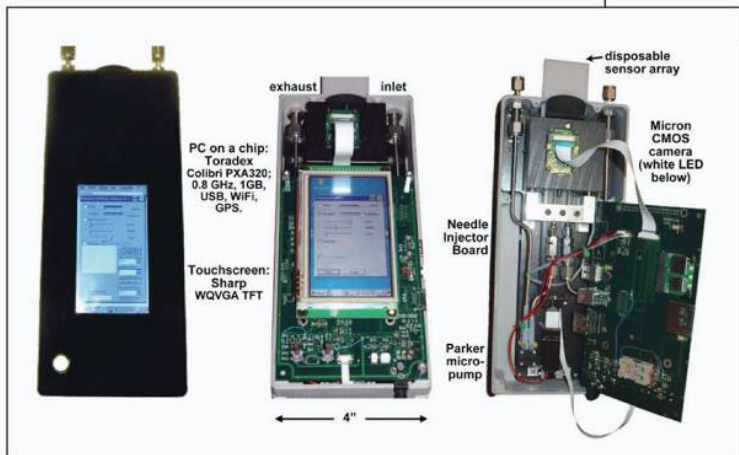
The process is similar to the human brain, which



To build the reference library for his electronic nose, Suslick exposed the array to many substances and recorded the resulting colored dot patterns.

holds a library of smells people collect all their lives. Whenever one senses an odor, the brain tries to connect the smell with one that's already familiar. To build the reference library for his electronic nose, Suslick exposed the array to many substances and recorded the resulting patterns of colored dots. Now, the unit can compare the colors produced by a known substance with what is seen for a substance in question.

Unlike the human nose, the sensor array is disposable and snaps in and out of the optical reader. The



A SURPRISE IN EVERY PACKAGE

DRUGS

Buster K910B Density Meter.

EXPLOSIVES

FV Series Fiberscope with camera.

CASH

Laser Rangefinder.

The Buster K910B and CT-30 Detection Kits, as used by the U.S. Department of Homeland Security.

AVERAGE CONFISCATIONS OF OVER \$250,000 PER YEAR PER KIT, PLUS DRUGS.

CSECO Campbell/Harris Security Equipment Company
 Ph: 510-864-8010 email: info@cseco.com cseco.com

Circle 73 on Reader Service Card

**EVERY AED
 EVERY MODEL
 BEST PRICE
 ORDER TODAY
 SHIPS TODAY**

AEDSuperstore.com
800-544-0048

Circle 72 on Reader Service Card

COVER STORY

camera in the reader is not much different than a typical cell phone camera.

War of the noses

To test the application of the sensor array, Suslick and colleagues chose 20 representative examples of toxic industrial chemicals, including those chemical concentrations known to be immediately dangerous to life or health, such as ammonia, chlorine, nitric acid and sulfur dioxide. The arrays were then exposed to the chemicals for 2 minutes. Most of the chemicals were identified from the array color change in a matter of seconds and nearly 90 percent of them were detected within 2 minutes.

In these tests, sensitivity was increased to about five percent of the permissible exposure level.

"That means ... we can monitor for 20 different analytes well below a level

where you have to worry about what you are being exposed to," Suslick says.

In earlier studies, Suslick's team demonstrated the ability of the technology to discriminate chemical compounds in complex mixtures such as sweeteners, soft drinks, beers and coffee (no small achievement since roasted coffee beans contain more than 1,000 chemical compounds.) The opto-electronic nose was so sensitive it could distinguish between 10 commercial brands of coffee and also differentiate coffee beans roasted at various temperatures for different times. Currently, the researchers have a fully functional prototype handheld device.

One of the benefits of the Suslick technology is that its components are readily available and relatively inexpensive. Given the broad range of chemicals it detects, and the high sensitivity of the array to those compounds, the device

could be particularly useful on police patrols, as well as in occupational settings.

The idea of an electronic nose is not new. The Jet Propulsion Laboratory, for one, has been working on its version for several years. The JPL ENose is designed as an air-quality monitor to provide fast, early identification of atmospheric changes aboard the International Space Station and Space Shuttles. Interestingly, the ENose has also shown the ability to detect the odor differences between normal and cancerous brain cells.

Nose for trouble

The Illinois researchers hope to be able to market their wearable nose sensor in the not-too-distance future. After further miniaturization it's possible that a cheap, disposable version could one day be pinned to window visors of patrol cars or even stitched to officer uniforms.



Any radio.
Anywhere.
Any time.

Interoperability refined.

The Telewave ANT280S Wideband Discone Antenna is an ideal tool for interoperability communications. Multiband capability, 500 watt power handling and excellent VSWR characteristics mean that no couplers or matchers are needed between 132 MHz and 3 GHz. Connect any radio and it "just works".

The ANT280S is fully welded and coated for maximum durability. At 10 lb. and only 36" tall, it's ideal for tactical deployment, mobile command centers, or permanent installation on a tower or rooftop. Many different attachment options are available for multiple radios, even in the same band.

**NOW WITH
118-132 MHZ
COVERAGE**

Telewave has provided innovative solutions for Public Safety, Government, and our Military for almost 40 years. Contact us today and find out what we can do for you.



San Jose, CA USA • 1-800-331-3396
www.telewave.com
An ISO 9001:2008 registered company

Circle 68 on Reader Service Card

Total Recall or TeleCorder?

Which multi-channel digital audio logger is the best solution to document your important conversations?

Total Recall - provide secure automatic recording, live monitoring, archiving, searching, and playback. Document conversations on 4 to 92 phones, phone lines, two-way radios, Analog/VoIP/ISDN/T1/PRI, etc. **Features include:** automatic archiving to built-in HDD/CD/DVD, password protected playback, plus live monitoring locally and via LAN/WAN/Dial-up. Use **Total Recall** to document your critical conversations - from \$5700.



Total Recall Desktop (TRL)



Total Recall Rack Mount (TRR)

Which digital audio recorder is best for your application?

TeleCorder - record either via USB connection to a PC (2 or 4 channels - from \$250), or stand-alone recording and playback plus USB connection to PC (2 or 4 channels - from \$750).



**OMNICRON
ELECTRONICS**
581 Liberty Highway
Putnam, CT 06260
860.928.0377
Fax: 860.928.6477

www.omnicronelectronics.com



TeleCorder (UC)



TeleCorder (TC)

Contact your Omnicron representative today
Recording Solutions Since 1975
Dealer inquiries welcome

Circle 69 on Reader Service Card

The nose has obvious extensions to other law enforcement applications, such as drug detection, where human or canine noses are currently the technology of choice. But Suslick has yet to explore those. His primary focus right now has been on toxic gases.

"We have also recently extended this to the detection of peroxide explosives, specifically TATP (triacetone triperoxide, the 'Shoe-Bomber' explosive), and have demonstrated exceptionally high sensitivity and specificity," Suslick says.

Suslick speculates his technology may eventually be useful for the identification of chemicals used in the preparation of illicit drugs such as methamphetamine, and also for the detection of accelerants used by arsonists.

First responders currently use a bewildering assortment of expensive devices to detect chemical toxins, explo-

sives, and illicit drug compounds, including Fourier Transform InfraRed (FT-IR) spectroscopy and mass spectrometry (MS). Recent improvements include handheld FT-IR, Raman spectrophotometers and portable gas chromatography-mass spectrometers (GC-MS).

Kelly Elkins, director of Forensic Science at Metropolitan State College of Denver, says toxin detection is headed for interesting times. "Scientists are interested in detecting toxins in food products and bacterial warfare detection using fluorescent biosensors," she says. "Counterfeit pharmaceuticals pose a major problem and forensic scientists are analyzing not only the chemical makeup of the drug molecules, but also the weave and chemical composition of the packaging, labeling ink and insert materials."

None of the current or future detection devices, however reliable, can be

depended on to be either inexpensive or disposable.

Once Suslick has his device in marketing condition, he estimates the cost of the handheld reader/camera unit will be a few hundred dollars. The replaceable arrays, he says, should cost only a few dollars each, if that.

"Our goal is to have something inexpensive enough that every first responder could be equipped with one," Suslick says. ■

Douglas Page writes about science, technology and medicine from Pine Mountain, Calif. He can be reached at douglaspage@earthlink.net.

MORE INFORMATION

For more information on these companies, circle the corresponding number on the Reader Service Card

COMPANY	READER SERVICE NO.
Raman	21

To aid in the prevention of prescription drug abuse and diversion

FREE Professional Educational Programs Presented by Experienced Former Officers

The Purdue Pharma Law Enforcement Liaison and Education Unit is staffed by retired law enforcement officials and offers...

Training – Topics include preventing and investigating all types of prescription drug diversion.

Placebos – For "reverse sting" undercover operations. Identical to real controlled substances manufactured by Purdue Pharma, but contain no controlled substances. Their use is restricted to criminal investigations.

Educational Materials – For example: drug ID cards with full-color, actual-size photographs of the most commonly abused prescription drugs.

Anti-Crime Program – RxPATROL® (Rx Pattern Analysis Tracking Robberies and Other Losses) is designed to assist law enforcement efforts to apprehend and prosecute pharmacy robbers and scammers, as well as to help protect pharmacies.

All of these programs are provided at no cost. Our goal is to help keep prescription drugs out of the hands of criminals, in order to ensure that they are available for patients with real medical needs.



For more information, contact the Law Enforcement Liaison and Education Unit at 203-588-7281
 Purdue Pharma L.P.
 One Stamford Forum, Stamford, CT 06901-3431
 Fax 203-588-6035 • E-mail: LEPrograms@pharma.com

© 2006, 2008, Purdue Pharma L.P. C7709-1/2C 8/08

Circle 70 on Reader Service Card