

**THOMAS THUNDAT**

He is closing in on a chip capable of monitoring 100 chemicals at a time. Tiny diving boards made of silicon, on screens, lie at the heart of this inexpensive sensor



How can you tell what's in the air?  
In a suitcase? In your blood?  
Meet science's detection pioneers.

# Beyond The Sixth Sense

THE  
MOLECULE  
HUNTER

## WHEN A LEVER MOVES THE WORLD

THOMAS THUNDAT'S FIRST JOB AT Tennessee's Oak Ridge National Laboratory wasn't exactly a glamorous start. When Thundat arrived in 1991, fresh from postdoctoral training, he was put to work in a dank bomb shelter that had been converted into a lab. His task was to use an atomic force microscope to get a "snapshot" of the DNA molecule. All he seemed to be getting, though, was a headache. The microscope, which detects the con-

tours of molecules by dragging a flexible sliver of coated silicon over them, was malfunctioning. After puzzling through his problem for months, Thundat realized one rainy day during a rare midday foray outdoors that the microscope's probe was warping as it sponged up moisture from the air. Intrigued, he ran a simple experiment and discovered that the probe was a marvelously precise hygrometer. If it could measure moisture, he wondered, why not all sorts of other stuff? Thundat, 46, has since built tiny sensors to detect trace amounts of everything from explosives to cancer markers to chemical weapons, winning scads of awards and 17 patents for his inventiveness.

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# INNOVATORS

SENSORS FORGING THE FUTURE

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Under a microscope, the sensors, called microcantilevers, resemble rows of diving boards or spatulas, each vibrating spontaneously. They can be made so thin that 100 would fit snugly inside a human hair. The cantilever is coated on one side with a chemical that specifically binds a target molecule—say, a cancer-related protein or a plastic explosive. When that molecule sticks to it, the cantilever bends and the frequency of its vibration changes, which can be measured by bouncing a laser beam off its surface. Thundat and his team are only months from completing an exquisitely sensitive handheld detector that will suck in air and search for a variety of explosives. Since the cantilever sensors are carved out with the same technology used to build computer chips, the detector should ultimately cost only tens of dollars. In airports today the only machine as sensitive—the mass spectrometer—is too large to carry around, costs \$100,000 and can't “sniff out” explosives molecules in the air.

Thundat has also shown that his sensor can detect proteins associated with prostate cancer. He and his team are now building arrays to detect markers for other cancers, heart disease and even mutant genes. In his spare time, Thundat is trying to figure out how to make his sensors more robust and discerning than they are, hoping to deploy them as cheap detectors of land mines, which cripple and kill thousands of people every year in war-ravaged nations like Angola. “We have a long way to go,” he acknowledges. “Right now my friends tell me they wouldn't walk behind me and my detector in a minefield.” If Thundat's track record is any indication, his friends might be in for a field trip sooner than they think. —**By Unmesh Kher/Oak Ridge**