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Metabolomx makes machine to detect cancer by smell

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A few years ago, researchers in California received widespread attention for showing that dogs can smell cancer on a human's breath. With 99 percent accuracy, the canines could detect if a person had lung or breast cancer, beating the best figures from standard laboratory tests. Subsequent studies confirmed the results and provided further evidence that dogs really are man's best friend.

The problem with cancer-detecting dogs is that, well, they're dogs. Hospitals haven't embraced the idea of a diagnostic tool that poops, barks and requires feeding.

With such concerns in mind, technology startups have hustled to build digital devices that can mimic the dogs' olfactory sense and reduce the need for biopsies and CAT scans.

Metabolomx, a 12-person outfit in Mountain View, now appears on the fast track - insofar as such a thing exists in the heavily regulated medical field - to bringing a cancer-sniffing device to market.

The Metabolomx machine looks like a desktop PC with a hose attached. It sits on a cart that can be wheeled up to a patient, who is instructed to breathe in and out for about four minutes.

The machine analyzes the breath and its volatile organic compounds, or VOCs - aerosolized molecules that, among other things, determine how something smells.

Tumors produce their own VOCs, which pass into the bloodstream. The lungs create a bridge between the bloodstream and airways, so the breath exhaled by a patient will carry the VOC signatures of a tumor if one is present. "It may seem surprising, but it's actually very straightforward," says Paul Rhodes, the co-founder and chief executive officer at Metabolomx.

Dr. Peter Mazzone, a lung cancer expert at the Cleveland Clinic, recently published results from a trial he ran with an early version of the Metabolomx machine.

He studied 229 people and found that the machine could detect lung cancer more than 80 percent of the time.

Machine outdid dogs

Just as intriguing, the machine outdid the dogs by distinguishing between different forms of lung cancer with about 85 percent accuracy, giving the doctor insight into whether a patient had an aggressive case.

The goal now is to use a far more sensitive, updated version of the machine in new trials and see if it can get to 93 percent accuracy - a figure doctors say would make the device viable for widespread use.

Much of the technology behind the Metabolomx machine came from research done by co-founder Kenneth Suslick, a professor of materials science and engineering at the University of Illinois. Suslick and his team created a way to form sponges made of silicon, each about half a millimeter across, that are combined with a pigment. Dozens are laid on a plastic film.

As VOCs such as toluene (a lung cancer indicator) interact with the film, the sponges change color to show how strongly they are reacting to the various compounds. The scent of an orange will throw off a pattern of multicolored balls distinct from that of a lemon, for example.

Having a bit of fun with the technology, Suslick has published scientific papers showing his ability to distinguish between very similar products. The sensors prove that dark sodas like Coke and Pepsi share many similarities but enough unique characteristics to tell them apart.

Suslick's technology can even tell the difference between various Starbucks blends, while also disclosing that Folgers decaf smells almost identical to original Maxwell House.

The newer version of the Metabolomx machine quintuples the number of sensors and improves upon the underlying chemistry, making it 100 to 1,000 times more sensitive, though it's unclear what the impact on accuracy will be.

"The new machine is a big improvement and has really got me excited," says Dr. James Jett, a professor of medicine at National Jewish Health hospital in Denver and one of the world's leading lung cancer experts.

New lung cancer study

This month, Jett will join Mazzone in launching a new lung cancer study using data from the revamped machine. (The Mayo Clinic may soon join the study.)

The grand goal this time is to collect data on thousands of patients' breath signatures and analyze the data with computer algorithms.

"This system needs to be trained on people's age, smoking history and other health conditions," Mazzone says. "Then we can say, 'Your breath matches most closely with this 60-year-old woman in our signature library.' "

Early indications show that the Metabolomx technology should work in detecting multiple types of cancer, including breast and colon. But the company has opted to focus on lung cancer initially because it's complicated to diagnose.

Patients will often display spots on CT scans of their lungs, but it's difficult to tell whether the underlying nodules are cancerous or what type of cancer is present without a biopsy, which can be both painful and dangerous.

"It's a ways off before you replace a test like a biopsy, but it's now conceivable that we would get there," says Jett.

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