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CHEMISTRY

Putting Your Life in Your Pocket?

Pocket home sensor could test for viruses, bacteria, even cancer.

In the not-too-distant future, people might be able to walk into their local pharmacy, pluck a box off the shelf, and after a 10-minute test determine whether it's possible that they have cancer.

LAS researchers have laid the groundwork for such a remarkable scenario by adapting the common glucose meter to test for all kinds of substances, from lead in water and pesticides on our vegetables to bacteria and viruses in our blood. It could even someday detect cancer or HIV.

Prior to this work, University of Illinois chemistry professor Yi Lu had developed a meter that tests for lead in water—an on-site sensor that is much cheaper than sending water samples off to labs for testing. However, the lead sensor is aimed at the water industry, not the general public.

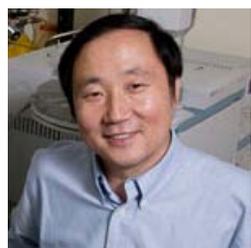
"During that entire development process there was always one thing on my mind," Lu says. "What about home users? Could we develop a sensor that was cheap enough for use by the public and versatile enough to measure many different things?"

Not only could they do it, but they did.

"When I went to Walgreens or other similar stores, I constantly saw glucose monitors on the shelf, readily available. So it occurred to me: What can we do to utilize them?"

Various laboratories, including students in Lu's own lab, have tried to create a more versatile sensor by tinkering with the inner workings of the popular glucose meters, which diabetes patients routinely use to check their blood sugar levels. But Lu ultimately decided they didn't want to modify the glucose meter because if people have to buy a new, modified meter, it will create another barrier for them to adopt the new technology. Instead, Lu's team decided to use the existing meters, as is, for their new system.

Lu and postdoctoral researcher Yu Xiang found that they could use glucose meters to successfully test for minute traces of four substances: cocaine, uranium, adenosine, and a disease marker for tuberculosis. They intentionally chose four dramatically different targets to determine the versatility of their system.



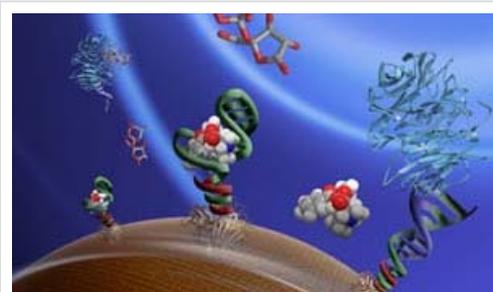
Chemistry professor Yi Lu and colleagues have found that glucose meters can be used as simple, portable, inexpensive meters for a number of target molecules in blood, serum, water, or food.

The system works because they found a way to link the level of these target substances with the rise in glucose levels shown on a store-bought meter. For example, the presence of a target molecule, such as uranium, releases the enzyme invertase; and the invertase, in turn, converts sucrose to glucose.

In other words, when levels of uranium go up, so do glucose levels, and this is measured by the standard glucose meter. The same link with glucose levels can be made with other substances as well, giving the system its versatility.

What Lu envisions is that various kits will be available on the shelf containing strips that could be inserted into an existing glucose monitor in place of the typical strips used by diabetes patients. One kit would contain strips to measure bacteria levels, another kit would contain strips to measure toxins in water, and so on.

However, he cautions that a home-testing sensor may not always replace the more sophisticated lab tests done by hospitals. It would mostly act as a way to screen for various conditions, and a positive reading above the threshold level



U of I chemists coupled functional DNA sensors and glucose meters for fast, easy, portable detection of drugs, toxins, disease markers and other molecules in blood, water or food. (Image by Li Huey Tan, Yu Xiang, and Yi Lu)

(Photo by L. Brian Stauffer)

would alert people that they need to see a doctor for further, in-depth testing.

Lu is developing a company to commercialize the new system, and by making use of glucose meters they can tap into an existing \$10 billion market. They also take advantage of equipment that has been finely engineered over the past 30 years, rather than start from scratch.

Lu and Xiang aim to simplify their process, and they are also trying to determine what target substances they should concentrate on first. One possibility is to use their system to measure other diabetes indicators in addition to glucose.

"Glucose levels are a good indicator for diabetes but not always enough," he says.

When Lu commercialized his lead sensor, he was often asked how long it would take for it to reach the market. He estimated five years, but it actually took closer to nine years, becoming available in 2009.

"But we had to develop that market, so I'm more optimistic about this sensor since the market for glucose meters already exists," he says. "I think it could be available within five years."

By Doug Peterson

October 2011

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