While millions of Americans — an estimated 17 million — suffer from diabetes, astonishingly there are even millions more who are unaware they even have contracted the potentially fatal disease. While some might have been misdiagnosed, there are millions suffering from symptoms of the disease who refuse to see a doctor, whether it be because of negligence, a lack of health insurance, or, the all too common fear.

Researchers at Mississippi State University’s Diagnostic Instrumentation and Analysis Laboratory (DIAL) believe they have the solution to this overwhelming problem. They have developed a sensor that uses cavity ringdown spectroscopy — an absorption method that attunes light rays to a given substance and measures the time required for the light to fade or “ring down” — that could one day ensure an affordable, accurate diagnosis through breath analysis without the need for intrusive blood and urine tests. The system detects levels of acetone in an individual’s breath.

“At first, the technique was being used to detect semi-volatile air pollutants,” says John Plodinec, DIAL’s director, “but then we did a little bit of work to see how we could pickup acetone and see how enriched it is in the breath. “It turned out to be kind of a good news/bad news situation,” he continues. “We found that acetone certainly was enriched in the breath of diabetics. The bad news was it was present in levels, for true diabetics, in the order of from 50 to 60 parts per billion — so it’s very minute traces. The good news was, after some testing, we were able to pick up acetone in the parts-per-trillion, so we had a very sensitive technique that could operate on breath blown into it.”

The technique, which has been worked on by Chuji Wang, an assistant research professor at DIAL, took a year to develop and works by having a person blow into the instrument’s cavity. Within microseconds, laser pulses go through the air puff and a measurement is made to determine the concentration level of acetone. The machine then produces a number that gives a preliminary indication of whether someone is diabetes-free or in the early to severe stage of the disease.

According to Plodinec, who first learned about breath analysis applications while serving in the Vietnam War, the process takes seconds and could one day be done in pharmacies and malls — much like blood pressure machines — through the use of disposable mouth pieces.

“We don’t believe there will be any false-negative diagnoses,” Plodinec explains. “It may have some false-positive diagnoses if someone has been eating a lot of fruit prior to the test because certain fruits give off acetone when they metabolize.

“One of the nice things about going for the screening market is we’re filling a hole that’s out there and we’re not trying to do any treatment,” he continues. “It alerts people that they may have a problem.”

Plodinec expects the sensor to be commercialized within the next two to three years. Currently, DIAL is working with potential commercialization partners, which could be finalized by year’s end, while also preparing for human testing, and eventual FDA approval.

“While we have not yet had medical testing, I can say that every medical person we’ve discussed the instrument with has been uniformly excited about its potential,” Plodinec says. “They feel it would fill a major gap in the diagnosing of diabetes.”

Beyond diabetes, Plodinec says the machine, when armed with the proper measurements, also could be used to detect other conditions that contain markers in the breath, such as SARS, lung cancer (which has a marker of alkanes), and breast cancer (marked by formaldehyde), in the not too distant future.

“Diabetes is the first step because there’s a huge need there,” Plodinec says. “Because of the interest from the medical community, we’re going to get this out. Once we have a manufactured item, we’ll have to do a little more development work to go into testing for other conditions.”

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