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## **A Faster Way to Detect Heart Attacks**

A diagnostic chip tests saliva to determine if someone is having a heart attack.

By Kristina Grifantini

A newly developed saliva-based test could give physicians and emergency-care technicians a quicker and easier way to diagnose heart attacks. The nano-biochip test, developed at the University of Texas at Austin and supported by the National Institutes of Health (NIH), measures proteins, or [biomarkers](#) (<http://www.technologyreview.com/Biotech/20411/?a=f>), in the saliva that researchers found correspond with heart attacks.

The nano biochip is a tiny protein microarray about the size of a dime that lies in a larger card. There's a "mini swimming pool" on the card where the saliva is placed, says [John McDevitt](#) ([http://www.cm.utexas.edu/Faculty-and-Research/Faculty-Directory/Individual-Faculty-Pages/john\\_mcdev](http://www.cm.utexas.edu/Faculty-and-Research/Faculty-Directory/Individual-Faculty-Pages/john_mcdev)), professor of biochemistry at the University of Texas at Austin and principal investigator of the nano-biochip project. The card slides into an analyzer about the size of a toaster, where the fluid is pushed into the nano biochip. Proteins are captured on microbeads; different protein biomarkers become color-coded with fluorescent dyes, letting the analyzer read the levels of each using a video chip (like the ones in digital cameras) that takes pictures at different wavelengths. The result is either a healthy-protein fingerprint or heart-attack fingerprint on the analyzer's display.

Heart attacks are currently diagnosed by biomarkers in the blood, along with electrocardiograms. But EKG still miss a large number of heart attacks, particularly those with lesser or atypical symptoms, according to [Denis Buxton](#) (<http://public.nhlbi.nih.gov/newsroom/home/ShowBio.aspx?PID=192>), a physician and branch chief of advanced technologies and surgery at NIH, who adds that roughly 25 percent of heart attacks are not usually detected by an EKG in an ambulance. And while a blood test done in the hospital increases the accuracy of the diagnosis, such tests require time for the blood to be drawn and analyzed.

Potential biomarkers are harder to detect in saliva than in blood, and this required researchers to develop more-sensitive protein tests. But an easily administered, and therefore faster, saliva test could be beneficial those suffering from heart attacks, because "damage increases with time [that heart attacks] are not treated," says Buxton.

The heart attack not picked up by an EKG "is one of the blind spots we'd like to help with," says McDevitt, adding that the first step would be putting the saliva tests in ambulances, where the analyzer would be next to the EKG and done at the same time. "The combination of both of these is ultimately what diagnoses the patient most accurately," says McDevitt.

So far, McDevitt's device has been tested on 59 patients, 29 of whom were heart-attack victims. With EKG measurements alone, the researchers detected only 67 percent of heart attacks, while the EKG and the saliva tests together identified 97 percent of the patients having heart attacks, according to McDevitt. The researchers found 32 proteins that were altered during a heart attack and, of those selected, four that the researchers decided were the best indicators of a heart attack.

The team envisions eventually placing the detection chip and reader in doctors' offices and health-care facilities. McDevitt is a scientific advisor to [LabNow](#) (<http://www.labnow.com/>), a company that hopes to commercially develop the chip. It plans to get the disposable chip down to less than \$20 each, while the

analyzers that would be in ambulances and physicians' offices are "basically souped-up digital cameras" and cost in the thousands. McDevitt says that the next trial, in ambulances, should begin this summer.

A heart-attack detection that analyzes saliva has some key advantages, according to James Januzzi, an associate professor of medicine at Harvard Medicine School and chief of the Coronary Care Unit at Massachusetts General Hospital. "The test can potentially be done much earlier, with much more rapid results than if they were done off of blood," he says. He adds that, in heart-attack treatment, "delays in diagnosis and delays in presentation are the two biggest problems right now. We have excellent therapies, but the problem is . . . the diagnosis is delayed. Time is of the essence in treatment."

Others, however, are unsure if the nano biochip will be useful in clinical practice, because there is a time lag for the proteins to show up in saliva, as is the case in blood. "The biomarkers take time to go up," says Thomas Wang, a physician at Massachusetts General Hospital and assistant professor at Harvard Medical School who has studied cardiovascular biomarkers. Many proteins, he points out, take hours to become elevated, so having a faster test may not necessarily be beneficial. "The concept is interesting," he says, but the researchers "would have to demonstrate that being able to make the diagnosis in the ambulance translates to any clinical benefit."

Some biomarkers do take several hours to show up, acknowledges McDevitt, but he says that the proteins are detectable at lower levels at earlier times than blood biomarkers are. He speculates that because saliva is constantly replenished, it may show a quicker response than blood. One protein that the group tested for, myoglobin (which elevates in other injuries as well), is one of the faster biomarkers, taking four hours for maximum levels to appear in saliva, according to McDevitt.

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