

Talking up a new role for cell phones in telemedicine

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In the first image, the entrance to the microfluidic device (bottom center of strip) is dipped into urine. Next, the urine wicks into the assay zones. In the third photo, a cell phone camera digitizes the results and transmits them to an expert. Finally, an expert interprets the results and replies with a treatment. Credit: Courtesy of George M. Whitesides, Harvard University

After launching a communications revolution, cell phones are talking up a potentially life-saving new role in telemedicine — the use of telecommunications technology to provide medical diagnosis and patient care when doctors and patients are hundreds or thousands of miles apart. Researchers in the United States and Brazil describe development of a simple, inexpensive telemedicine system that uses ordinary cell phone cameras to collect medical data from patients and transmit the data to experts located offsite for analysis and diagnosis.

The system is ideal for developing countries or remote areas lacking advanced medical equipment and trained medical specialists, the researchers say. The system can also transmit urgent medical data from battlefields, disaster zones, and other dangerous locations, they say. The

study is scheduled for publication in the May 15 issue of the American Chemical Society's *Analytical Chemistry*, a semi-monthly journal.

The key to a successful medical treatment is a quick, accurate diagnosis of disease. But some areas, particularly in developing countries, lack access to advanced medical equipment and trained medical personnel that are required for a speedy diagnosis. A better, more practical system for conducting medical analysis in these remote areas is needed.

Enter cell phones: The popular, inexpensive devices are owned by almost 3 billion users worldwide, or roughly half the world's population. Millions of new cell phone users are added each year in countries such as Africa, India, China, and South America. When equipped with cameras, the ubiquitous devices can conceivably be used in remote areas as the eyes and ears of doctors without the need for an on-site visit.

“The cellular communications industry is, and will continue to become, a global resource that can be leveraged for detecting disease,” says study leader George M. Whitesides, Ph.D., a professor of chemistry at Harvard University in Cambridge, Mass. Two recent studies by other researchers showed that cell phones can be used to acquire and transmit images of wounds and rashes to off-site locations for diagnosis, he notes.

In the new study, Whitesides collaborated with researchers in Brazil to design a prototype system that combines cell phone cameras with easy-to-use, paper-based diagnostic tests that undergo color changes when exposed to certain disease markers. The researchers demonstrated the feasibility of the system by using paper test-strips to collect and characterize artificial urine samples, as urine can be easily obtained from patients and contains a wide range of disease markers.

Using a simple cell phone camera, the scientists took pictures of the color-changing test-strips and transmitted them remotely to an off-site

expert. The trained expert accurately measured glucose and protein levels — used as hallmarks to diagnose various kidney diseases — from the test-strip image. Similar tests can be conducted on other body fluids, including teardrops and saliva, the researchers say.

Besides diagnosing diseases in humans, the system can also be used to detect disease in plants and livestock and for testing the quality of water and food, the researchers say. The development of cheaper, mass-produced diagnostic tests will make the system more widely accessible in the future, notes Whitesides, who is known for his pioneering research toward making medical diagnostic tests more widely available for the developing world. He is also the recipient of the 2007 Priestley medal, ACS' highest honor.

Source: American Chemical Society

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