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EDITOR'S COLUMN

Sending Body Signals

In the not-too-distant future, doctors may be keeping their distance from patients. But treatment won't necessarily suffer—in fact, it may just improve. And as is the case with any good relationship, communication is the key.

Pegged as one of the most promising growth markets, remote patient monitoring offers the potential for around-the-clock observation and preventive care despite fewer face-to-face doctor-patient interactions. In order for these complex remote-monitoring applications to enter into widespread use, however, they require the support of efficient emerging communication technologies such as wireless body-area networks (BANs).

An evolving technology, BANs consist of implanted or body-worn sensing technologies that wirelessly transmit patient data to a base station, which, in turn, shares the information with the physician via the Internet. The expectation is that a physician can be alerted to abnormalities and then respond to the data, if necessary, by initiating treatment without being in the same building or even the same town as the patient.

"A wireless communication network around the body allows real-time information access and localization with emerging implant and body-mounted sensors collecting health-related parameters," says Kaveh Pahlavan, a professor of electrical and computer engineering and director of the Center for Wireless Information Network Studies (CWINS) at Worcester Polytechnic Institute. "This enables the possibility of instant diagnosis, drug delivery, and mechanical operation of nanorobots inside the body."

Supported by a \$1.2 million grant from NIST, CWINS aims to apply knowledge gleaned from its work on such large-scale networks as Wi-Fi and Bluetooth to the optimization of high-speed wireless BANs. One of the only U.S.-based teams researching this area, CWINS is specifically exploring the propagation of radio waves through and around body surfaces as a means of exchanging information. But measurement and modeling of radio propagation has proven difficult for wireless applications, according to the researchers, because the channels experience temporal, spatial, and direction-of-arrival fading. Addressing this particular challenge is the group's primary focus.

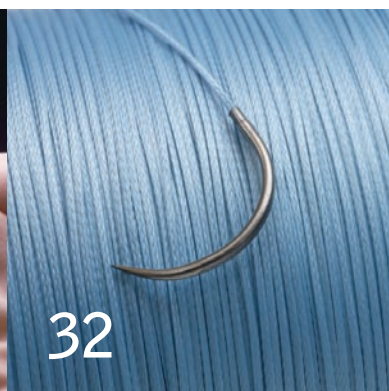
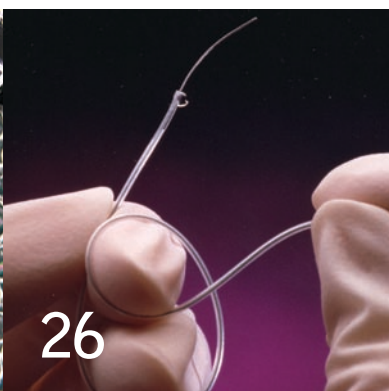
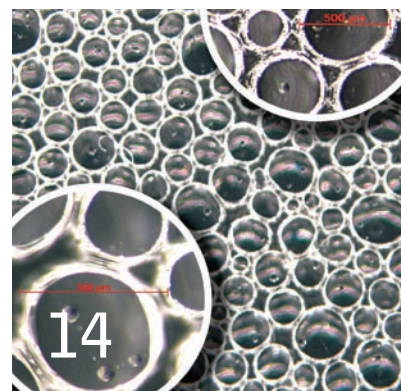
Measurement and modeling approaches aren't the only barriers to commercialization, though. The buzz-worthy issue of security applies to BANs, which are communicating confidential patient information. Furthermore, the industry-wide challenge of power management is also at play since wireless sensor networks are typically battery powered.

Yet despite these challenges, there has been progress: the FCC recently dedicated frequency bands for medical device radiocommunications (MedRadio), and IEEE 802.15.6 was established to promote international standardization. Forward-thinking OEMs are even paving the way for use of BANs. "Certain companies are designing wireless communication chip sets operating on the existing regulated bands for integration into medical devices such as wireless endoscopy capsules with camera or pacemakers implanted in the body," Pahlavan notes. "This trend is expected to continue while researchers are working on how to use these chip sets to route the messages with minimum power consumption, maximum privacy, and precise localization."

In light of such progress, it will be interesting to see whether wireless BANs can go the distance as healthcare shifts from the hospital to the home.

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