FUTURESPEAK

Science's Potential to Create New Markets

KENNETH MARX

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If someone gets sick from food they have eaten, lab tests can detect the contaminant. But tests for the bacteria *E. coli* may take five days to confirm a positive reading. *Listeria* or *Salmonella* tests may drag on over a week. Meanwhile, children, whose immune systems are not fully developed, risk serious illness or even death.

Biosensor technology can produce test results quickly—often in hours, instead of days. According to its supporters, anything a lab test can do, a biosensor can do better. The technology also has the potential to be cheaper than labs, because more samples can be run at once.

A biosensor uses biological elements—such as antibodies, proteins or cells—as the basis of a sensor. The biological sensing element can determine whether the test sample contains a suspected molecule. The most successful commercial biosensors to date are blood-glucose monitoring kits for diabetics. Biosensors have been used to detect explosives, analyze drinking water and soil at hazardous waste sites, and aid in the development of drugs.

"We'd be fools not to take advantage of them," says Kenneth Marx, professor of chemistry and director of the Center for Intelligent Biomaterials at the University of Massachusetts at Lowell. The center has received over $1 million in federal grants for research into biosensors. *American Demographics*' Sandra Yin spoke with Marx on how this technology could transform the healthcare marketplace.

AD: *How do biosensors work?*
KM: They're like a lock and key. Only a specifiac shape will recognize the tumbler combination in a lock. When there's a perfect fit, tight bonds form between the molecule in the biosensor and the one under examination. The biosensor can then measure these changes electrically or optically and provide what amounts to a yes or no answer on the identity of the molecule. The magnitude of the signal is proportional to the concentration of what you're detecting.

AD: *What can they detect?*
KM: Biosensors can be used to detect just about anything you can imagine you'd want to test for. They could be developed to test for cancer or leukemia, herpes simplex, AIDS or other human pathogens.

AD: *Why isn't this research further along?*
KM: Government agencies only began to earmark funds for biosensor-based research in the past five years. Secondly, the cross-fertilization of ideas between disciplines is a recent development. Only recently did scientists who specialize in biomedical testing work with specialists in surface chemistry microfabrication.

AD: *What's the advantage of using biosensors to diagnose a disease?*
KM: Right now, when a doctor draws blood for a blood test, it is sent to the lab, and it may be days before the results are available. With a newer biosensor-based test, you let miniaturized systems do all the lab steps for you, then the biosensor gives you a reading. These kinds of tests will eventually be possible in a doctor's office.

AD: *How soon will we see biosensors at the hospital or in the clinical lab?*
KM: It could be as little as five to 10 years away. Federal Drug Administration (FDA) approval is the wild card.

AD: *What are the biggest or most interesting new markets for biosensors?*
KM: The pharmaceutical industry is one of the most promising markets for biosensors. Using them, scientists can get more information that is vital in the design of drugs. Most drugs fail due to toxicity that is discovered only late in testing. Biosensors deployed in the early test phases of a new drug would eliminate overly toxic compounds from the mix.

AD: *What implications does this have for drug development?*
KM: A drug usually takes close to 10 years to go from conception to market. Estimates of the cost to develop the drug run from $300 million to $800 million, including all the money spent on failed drugs. Biosensors could play a part in speeding up the drug creation process. They are just beginning to be used in high volume screening processes to identify new drugs for pharmaceutical companies or large biotech firms.

AD: *How might biosensors change health care in America?*
KM: Biosensors could revolutionize health care in America. Health maintenance organizations (HMOs) wouldn't have to pay for drugs that don't benefit people in their plans. Currently, if you're in the subgroup that has a bad reaction to a drug, you might even cost your HMO something. In the future, when drugs are designed for specific populations, biosensors could be used to classify people, based on their genetic makeup. That may save HMOs bundles of money when it's spread over a broad population. There's a tremendous amount of money to be saved in health care. ■