ANNE EISENBERG

Beyond the Breathalyzer: Seeking Telltale Signs of Disease

PEOPLE who are worried about bad breath often reach for a toothbrush, a Tic Tac or an Altoid.

But in the future, personal breath monitoring may include far more than breath fresheners.

Scientists are building sophisticated electronic and chemical sniffers that examine the puffs of exhaled air for telltale signs of cancer, tuberculosis, asthma and other maladies, as well as for radiation exposure.

"There are clear signatures in the breath for liver disease, kidney disease, heart disease" and diseases of the lungs, said Dr. Raed Dweik, director of the pulmonary vascular program at the Cleveland Clinic, who studies breath analysis. "My sense is that breath analysis is the future of medical testing, complementing many of the blood and imaging steps we do today."

"Breath is a rich matrix that can reflect our state of health or disease," Dr. Dweik said. In fact, he observed, breath is so rich in chemical compounds that fully understanding it has proved challenging. Each exhalation contains gases like carbon dioxide, of course, but also the volatile remains of recent snacks, medicines and even compounds inhaled from things like carpeting, upholstery or various kinds of air pollution.

But monitors can sort out these exhaled substances with increasing sensitivity, bringing breath analysis closer to widespread use as a noninvasive tool in medical diagnosis and treatment.

Menssana Research, a biotechnology company in Fort Lee, N.J., is testing a desktop system called BreathLink for use in rapid identification of active pulmonary tuberculosis and other diseases, said Dr. Michael Phillips, the company's chief executive and a professor of clinical medicine at New York Medical College in Valhalla, N.Y. The system is designed to work wherever there is an Internet connection.

Its analyzers can detect compounds in the breath in concentrations of parts per trillion — a billion times more sensitive than breath analyzers used by the police to detect blood-alcohol concentrations, Dr. Phillips said. To use Breathlink, a person breathes into a long tube, and a breath sample is collected and analyzed within the apparatus. The device can then detail chemical concentrations of the breath in graphics.

JIM LANG/CLEVELAND CLINIC

"Then we can send that information to our lab in New Jersey from anywhere in the world" for further analysis, he said.

BreathLink grows out of the company's earlier work on Heartsbreath, a procedure that monitors exhalations of patients with heart transplants for signs of rejection. Heartsbreath, approved by the Food and Drug Administration as a humanitarian device, has not yet been widely adopted, Dr. Phillips said, in part because Medicare has declined to cover the test until further clinical studies demonstrate its efficacy. Those studies are continuing, Dr. Phillips said.

The detection of one compound in the breath, nitric oxide, is already used widely in treatment of asthma, said Dr. Marielle W. H. Pijnenburg, who specializes in pediatric respiratory medicine at Erasmus University Medical Center in Rotterdam, the Netherlands.

"It's a very small molecule," she said, "but if you look at patients of asthma, they have higher levels of it in their exhaled air. It reflects their allergic inflammation in the lungs."

Dr. Pijnenburg said that the breath analyzers used to detect nitric oxide are expensive, however — and that the results, while useful, are not applicable to all asthma patients. "Nitric oxide alone is too simple to reflect the complex processes going on in the lungs for asthma," she said. Future devices will measure many other molecules that may be related to the disease.

One of these devices may be a portable breath analyzer for pediatric asthma that will look for five common inflammatory markers of the disease, said Frederick A. Dombrose, president of the Hartwell Foundation in Memphis. The foundation, which supports research in children's health, has awarded a grant to Cristina E. Davis, an associate professor of mechanical and aerospace engineering at the University of California, Davis, to develop the analyzer.

"We want a hand-held device that is convenient for children to hold and use, so that they can monitor their condition," Mr. Dombrose said.

MENSSANA RESEARCH

"My sense is that breath analysis is the future of medical testing," says Dr. Raed Dweik, left, with a breath sensor he is developing. Above, Anirudh Chaturvedi of Menssana Research demonstrated its BreathLink system.

AT the Cleveland Clinic, Dr. Peter Mazzone is analyzing the breath of patients to determine whether they have lung cancer. In his test, breath is drawn across sensors that change color and are then captured on digital cameras. The patterns are then compared with those of people without the disease. His tests have reached 85 percent accuracy so far in spotting people with the illness, he said.

But some trained dogs, he pointed out, can sniff out cancer with 99 percent accuracy — although without, for example, the ability to identify particular compounds the way some analyzers can.

"We are getting better and better," he said. "But whether we will ever approach the accuracy of the dog — we don't know." □

E-mail: novelties@nytimes.com.