Medical Xpress

A new technology for cancer screening listens for the signs of cancer

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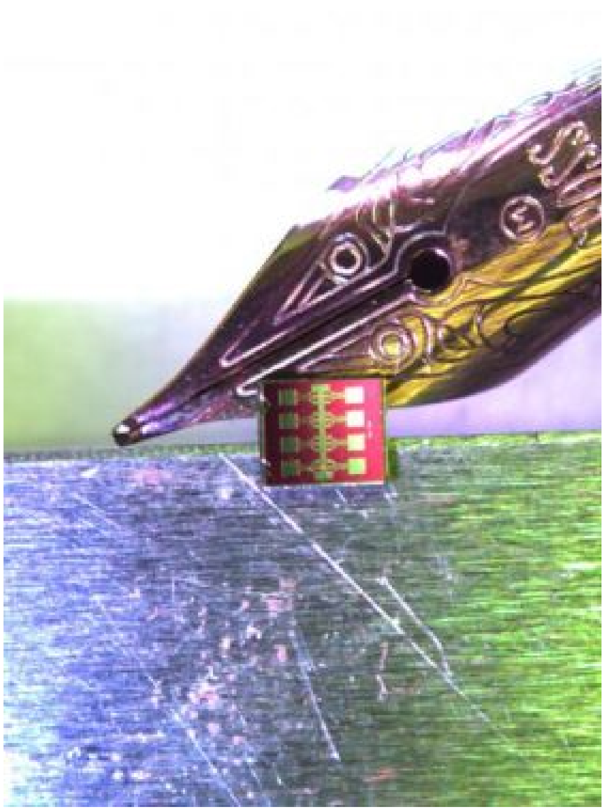

ACµRay(tm) sensor chip developed by Georgia Tech researchers for early detection of cancer. Credit: AACR

Cancer-sensing devices built as cheaply and efficiently as wristwatches – using many of the same operating principles – could change the way clinicians detect, treat and monitor cancer in patients. Researchers from the Georgia Institute of Technology have created an acoustic sensor that can report the presence of small amounts of mesothelin, a molecule associated with a number of cancers including mesothelioma, as they attach to the sensor's surface.

According to the researchers, the study is a proof of principle, demonstrating a technique that might work for the detection of nearly any biomarker – a collective term for a molecular signal that denotes the presence of disease. They present their findings today in Atlanta, Georgia at the American Association for Cancer Research's second International Conference on Molecular Diagnostics in Cancer Therapeutic Development.

"It is one thing to be able to identify biomarkers for a disease, but it is another to be able to find them in blood quickly and easily at very low concentrations," said Anthony Dickherber, a graduate student in the School of Electrical and Computer Engineering at Georgia Tech. "We envision that, one day, doctors can use an array of our sensors as a sort of laboratory in their office, where they could use a quick blood sample to detect or monitor the signs of cancer."

According to Christopher Corso, the other graduate student engaged in the project and an M.D., Ph.D. student, such a device would be a boon to healthcare practice, allowing physicians to screen patients for signs of disease before opting for more expensive or invasive diagnostic techniques. Responding to the growing need for such sensors in both research and clinical practice, Dickherber, Corso and research adviser William D. Hunt, Ph.D., conceived of and developed the ACuRay™ (pronounced ak´-u-râ) chip, standing for ACoustic micro-arRay – a device that shares more in common with an inexpensive wristwatch than the sort of cutting edge molecule-sorting apparatuses currently used by researchers and clinical laboratory technicians.

The array consists of a series of electrodes deposited on the surface of a thin film of zinc oxide, which allows the device to resonate, or vibrate, at a specific frequency when a current is applied, much like the quartz timing devices used in many clocks and watches.

"The sensor itself is built on a base of silicon, like a computer chip, and could be mass-produced using very well known and inexpensive microelectronic fabrication techniques," Dickherber said.

To turn this array into a sensor, the Georgia Tech researchers coated the zinc oxide surface with mesothelin-specific antibodies generated in the lab of Ira Pastan, M.D., at the National Cancer Institute. These molecules are engineered versions of the antibodies the immune system creates to identify foreign intruders, such as microbial parasites. In this study, the researchers coated the sensor with antibodies for mesothelin, a cell-surface protein that is highly expressed in mesothelioma, ovarian cancer, pancreatic cancer and other malignancies.

When the mesothelin binds to an antibody, the added mass changes the frequency at which the acoustic wave passes between the electrodes on the surface of the device. The device is able to "hear" the pitch change due to nanomolar concentrations of mesothelin (just a few molecules amid billions) binding to antibodies on the chip. The technology has the potential of detecting biomarkers in even lower concentrations than those tested, Dickherber said.

"It is really an elegant engineering solution to a very complicated problem," said Hunt, a professor of electrical and computer at Georgia Tech and lead researcher on the project. "We could, for example, detect a number of different markers for a single disease on a single chip no bigger than the tip of a fountain pen. With refinement, this technology could readily lead to an inexpensive, ubiquitous technology for researchers, physicians and the clinical laboratory."

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Source: American Association for Cancer Research