# New device uses gold nanoparticles to test for lung cancer

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The metabolism of lung cancer patients is different than the metabolism of healthy people. And so the molecules that make up cancer patients' exhaled breath are different too. A new device pioneered at the University of Colorado Cancer Center and Nobel-Prize-winning Technion University in Haifa, Israel uses gold nanoparticles to trap and define these molecules in exhaled breath. By comparing these molecular signatures to control groups, the device can tell not only if a lung is cancerous, but if the cancer is small-cell or non-small-cell, and adenocarcinoma or squamous cell carcinoma.

"This could totally revolutionize lung cancer screening and diagnosis," says Fred R. Hirsch, MD, PhD, investigator at the CU Cancer Center and professor of medical oncology at the University of Colorado School of Medicine. "The perspective here is the development of a non-traumatic, easy, cheap approach to early detection and differentiation of lung cancer."

The proof of concept, recently published in the journal Nanomedicine, showed that in a preliminary study the device clearly distinguished between the volatile organic compounds in cancer patients' exhaled breath compared to the breath of a control group. Subjects simply exhale into a bag, which separates superficial exhaled breath from breath that originated deeper in the lungs. And then this deep breath is analyzed by an array of gold nanoparticle sensors.

"What is unique here is that we take advantage of a nanotechnology

development going on at Technion University that allows us to immediately identify very small molecules," Hirsch says, and based on the identity of these small molecules in exhaled breath, Hirsch and colleagues can tell if the breath came from a cancerous lung.

The device's potential uses go beyond diagnosis.

"We can measure the levels of volatile organic compounds against population scores to diagnose cancer and types of cancer, or can measure the change in patients' levels of VOCs across time with the intent of, for example, monitoring how well a patient responds to specific treatments," Hirsch says. A breath now and a breath after treatment could define whether a patient should stay with a drug regimen or explores other options.

Personalized medicine has come to lung cancer – just as in years past it has come to breast and some other cancers. The sooner and more accurately you can define the cancer subtype, the more precisely you can target the disease. This new device could eventually help doctors quickly, simply, and inexpensively define patients' lung cancer subtypes, allowing them to pair therapies with subtypes early in the treatment process.

In fact, Hirsch and his colleagues will soon publish very encouraging preclinical data showing that the device's gold nanoparticle sensors can distinguish between different types of lung cancer cells.

The device may also help doctors smooth the wrinkles in existing methods of cancer screening. For example, the National Lung Screening Trial recently reported that one of the major challenges in its more than 53,000-person study of low-dose chest CT scans to detect lung cancer was the trial's nearly 95 percent rate of false positives – CT scans found nodules that turned out not to be cancerous.

"That calls for better measures to distinguish what's a benign nodule and a malignant nodule," Hirsch says. "That's what we in the lung cancer group here at the University of Colorado Cancer Center want to study with this technology, and we have very encouraging preliminary data. We could potentially use the exhaled breath to determine who among the individuals with a CT-detected nodule should go for further work up and/or eventually treatment."

Where an $1,800 chest CT struggles, simply exhaling may succeed.

"If it works, you can imagine standing in the grocery store and having high risk people blow into a bag," Hirsch says.

Provided by University of Colorado Denver