Carbon Nanotubes Detect Lung Cancer Markers in the Breath

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(PhysOrg.com) -- Using an array of nanotube devices, each coated with a different organic material, researchers at the Israel Institute of Technology have developed diagnostic system that may be able to diagnose lung cancer simply by sampling a patient's breath. The results of this study, which was led by Hossam Haick, Ph.D., appear in the journal *Nano Letters*.

Dr. Haick and his collaborators first created individual devices consisting of random networks of single-walled carbon nanotubes coated with 1 of 10 different insulating nonpolymeric organic materials. The investigators used standard microprocessor fabrication techniques to create the sensors. Thanks to the different organic materials used to coat the nanotubes, each sensing device provided a unique response when exposed to wide variety of the more than 200 volatile organic chemicals present in human breath.

To calibrate the devices, the investigators captured the breath of 15 nonsmoking healthy patients and 15 individuals with stage 4 lung cancer. Next, they concentrated the organic compounds in each breath sample using a method known as solid phase microextraction and then analyzed each sample using gas chromatography-mass spectrometry (GC-MS). GC-MS is a highly accurate technique that is too expensive and time consuming to find use as a routine diagnostic assay. The researchers then ran the same samples through their sensor array; the electrical output of the test devices changed in a way that was characteristic of the exact mixture of organic compounds found in the breath samples.

From these data, the investigators were able to distinguish between two response patterns from each of the 10 array members. There was no overlap in the response patterns between the healthy and lung cancer patients in these first tests. The researchers are now testing their system on a much larger group of patients and healthy subjects.

This work is detailed in the paper “Detecting simulated patterns of lung cancer biomarkers by random network of single-walled carbon nanotubes coated with nonpolymeric organic materials.” An abstract of this paper is available at the journal’s Web site.

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