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Capturing cell 'fingerprints' to advance cancer screening

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(PhysOrg.com) -- Researchers at Northeastern University have developed an early-stage, highly accurate cancer screening technology that determines -- in seconds -- whether a cell is cancerous, precancerous or normal.

The breakthrough technology, for which there is a patent pending, automatically captures a “fingerprint” of the cell’s biochemical composition, which is subsequently analyzed by a computer for abnormalities.

The new method, which currently can screen for oral, cervical and head-and-neck cancers, is faster, more accurate, and enables earlier detection than current screening methods. Those methods rely on the visual detection, under a microscope, of a few abnormally shaped cells among thousands.

Referred to as Spectral Cytopathology (SCP), the technology was pioneered by professor of chemistry and chemical biology Max Diem, head of Northeastern’s Laboratory for Spectral Diagnosis; chemistry and chemical biology research scientists Melissa Romeo, Ben Bird and Miloš Miljkovic; and several Northeastern graduate and undergraduate students.

“We are looking beyond traditional methods by focusing on detecting cellular changes that happen in the earlier stages of cancer, which will have a tremendous impact on patients,” said Diem.

“Cytologists [scientists who study the structure and function of cells] have the most difficulty identifying pre-cancers in the earliest stages,” said Romeo. “Our technology offers the ability to detect abnormal changes in cells even before (structural) changes become apparent.”

Earlier detection combined with greater accuracy—SCP has a greater-than 95 percent accuracy rate compared to 65 to 70 percent for current screening methods—would make a significant difference in patient survival rates.

The high death rate associated with oral cancer, for example, results from late- stage diagnoses, often after the cancer has metastasized. When discovered early, however, oral cancers have an 80 to 90 percent survival rate.

The technology behind SCP works by capturing a cell’s biochemical composition. After a cell sample is obtained through a minimally invasive exfoliation procedure, the cells are probed with infrared light, which interacts with the cell’s molecular components and produces a “fingerprint” of each cell’s biochemical composition. The data is analyzed by a computer, which reports if the cells are normal, cancerous or precancerous.

Traditional screening methods require cytologists to detect abnormalities by examining cells under a microscope to discover very subtle structural changes in just a few cells among as many as 10,000.

The new technology, which Diem estimates is no more than five years away from bringing into application, would relieve a testing logjam at existing cytology laboratories. There is a shortage of cytologists able to conduct the tests, he said, limiting the number of screenings that can be performed.

SCP “could be applied to several other forms of cancer and result in more early diagnoses, potentially improving the survival rate of patients with cancer,” added Diem. “Our ultimate goal is to have this application in doctors’ and dentists’ offices so that patients can be routinely screened.”

Provided by Northeastern University (news : web)