Microchip can detect type and severity of cancer

September 28 2009, By Elaine Smith

(PhysOrg.com) -- University of Toronto researchers have used nanomaterials to develop a microchip sensitive enough to quickly determine the type and severity of a patient's cancer so that the disease can be detected earlier for more effective treatment.

Their groundbreaking work, reported Sept. 27 in *Nature Nanotechnology* heralds an era when sophisticated molecular diagnostics will become commonplace.

"This remarkable innovation is an indication that the age of nanomedicine is dawning," says Professor David Naylor, president of the University of Toronto and a professor of medicine. "Thanks to the breadth of expertise here at U of T, cross-disciplinary collaborations of this nature make such landmark advances possible."

The researchers' new device can easily sense the signature biomarkers that indicate the presence of cancer at the cellular level, even though these biomolecules - genes that indicate aggressive or benign forms of the disease and differentiate subtypes of the cancer - are generally present only at low levels in biological samples. Analysis can be completed in 30 minutes, a vast improvement over the existing diagnostic procedures that generally take days.

"Today, it takes a room filled with computers to evaluate a clinically relevant sample of cancer biomarkers and the results aren't quickly available," says Shana Kelley, a professor in the Leslie Dan Faculty of

Pharmacy and the Faculty of Medicine, who was a lead investigator on the project and a co-author on the publication.

"Our team was able to measure biomolecules on an electronic chip the size of your fingertip and analyse the sample within half an hour. The instrumentation required for this analysis can be contained within a unit the size of a BlackBerry."

Kelley, along with engineering professor Ted Sargent - a fellow lead investigator and U of T's Canada Research Chair in Nanotechnology - and an interdisciplinary team from Princess Margaret Hospital and Queen's University, found that conventional, flat metal electrical sensors were inadequate to sense cancer's particular biomarkers. Instead, they designed and fabricated a chip and decorated it with nanometre-sized wires and molecular "bait."

"Uniting DNA - the molecule of life - with speedy, miniaturized electronic chips is an example of cross-disciplinary convergence," says Sargent. "By working with outstanding researchers in nanomaterials, pharmaceutical sciences, and electrical engineering, we were able to demonstrate that controlled integration of nanomaterials provides a major advantage in disease detection and analysis."

The speed and accuracy provided by their device is welcome news to cancer researchers.

"We rely on the measurement of biomarkers to detect cancer and to know if treatments are working," says Dr. Tom Hudson, president and scientific director of the Ontario Institute for Cancer Research. "The discovery by Dr. Kelley and her team offers the possibility of a faster, more cost-effective technology that could be used anywhere, speeding up diagnosis and helping to deliver a more targeted treatment to the patient."

The team's microchip platform has been tested on prostate cancer, as described in a paper published in ACS Nano, and head and neck cancer models. It could potentially be used to diagnose and assess other cancers, as well as infectious diseases such as HIV, MRSA and H1N1 flu.

"The system developed by the Kelley/Sargent team is a revolutionary technology that could allow us to track biomarkers that might have significant relevance to cancer, with a combination of speed, sensitivity, and accuracy not available with any current technology," says Dr. Fei-Fei Liu, a radiation oncologist at Princess Margaret Hospital and Head of Applied Molecular Oncology Division, Ontario Cancer Institute. "This type of approach could have a profound impact on the future management for our cancer patients."

Source: University of Toronto

Citation: Microchip can detect type and severity of cancer (2009, September 28) retrieved 9 April 2024 from https://phys.org/news/2009-09-microchip-severity-cancer.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.