MedicalXpress

Scientists develop new method for 'extremely' early cancer detection

November 2 2012

It may soon be possible to test a person for cancer with just a drop of their blood and a small machine. As part of a European research project, scientists have developed a device for detecting the HSP70 protein, which is over-expressed in patients with many types of cancer. The objective: to make a diagnosis extremely early in the disease process, thereby improving outcomes for patients.

HSP70, a protein indicating stress in the human body, is a biomarker for prostate, colon, esophagus, lung, and brain cancer. Being able to track this protein in patients, making early diagnoses of these types of cancer much more likely, would therefore be very useful for doctors. As part of the "Spedoc" European Research Project, an EPFL team is developing an extremely sensitive, easy-to-use HSP70 detection platform. The device, which will be no bigger than a small suitcase, is expected to be on the market in 2014.

How does it work?

The Spedoc platform requires only a drop of the patient's blood. The blood is inserted in a chip that contains many microchannels. Inside each of the channels are tiny and circular structures made out of gold, with a particular "anti-body" surface chemistry that is designed to "trap" HSP70. As the blood flows through the channels, the HSP70 proteins are trapped by the structures, of which there are thousands in the pathway that the blood follows through the chip.

The next step in the process involves advanced plasmonics, which the team uses to determine the number of HSP70 proteins trapped on the circular nanostructures. If HSP70 is in fact over-expressed in the blood sample, it would mean that the patient would require further tests to detect cancer cells developing somewhere in the body.

Light detection

Two EPFL professors have joined forces on the HSP70 project. Sébastian Maerkl is head of the Laboratory of Biological Network Characterization (LBNC), which is developing the chip measuring 1 cm2. The chip contains layers of microfluidic channels that are no wider than a human hair. It is designed to break down the blood sample into its various components.

Olivier Martin's Nanophotonics and Metrology Lab (NAM) is in charge of the detection side of the device-design process: the NAM team is developing gold nanostructures, as well as optimizing a process to identify the HSP70 protein. "Our technique involves shining white light on the microfluidic channels," says Olivier Martin. "If a protein is caught on a nanostructure, we will observe small changes in wavelength as the light is refracted, compared with the initial light. In other words, there will be a change in color that can be observed with a spectrometer."

This is due to what is known as a surface plasmon resonance, which occurs when the electrons of a metallic nanoparticle oscillate together when they are stimulated by light. Depending upon whether the nanostructure has an HSP70 protein on it, the oscillations will be measurably different, making it possible to determine whether a given nanostructure has trapped a protein or not. The physical phenomenon of resonance oscillation upon which all of this depends only occurs at very small scales. "The resonance is so sensitive that we can detect tiny quantities of a given molecule."

Available soon at your doctor's office?

The Spedoc early detection method has many advantages: fast and non-invasive, it could replace costly cancer biomarker detection methods. "Cosingo, a Spanish company that's involved in the project, has already built a prototype, but quite a few improvements still need to be made," says Olivier Martin, who nonetheless can imagine a long-term scenario where such a test is widely used. "Doctors would use our platform as a cancer screening test during their patients' regular checkups, which could lead to extremely early diagnoses."Could this be the beginning of revolution in cancer treatment? The Lausanne University Hospital (CHUV) oncologist and Professor of Medicine Olivier Michielin takes a cautious stance, commenting, "The HSP70 test seems quite interesting. However, it will be a long time before it becomes a routine test, although this protein is in fact high in patients with many types of cancer. In particular, it still needs to be proven that early HSP70 detection can actually change the way patients are treated and lead to real improvements in outcomes for specific types of cancer."Whatever the case may be for HSP70, however, the Spedoc platform will certainly prove to be useful."Once we have worked out the general principle, the test itself can always be adapted for use on other biomarkers," notes Sebastian Maerkl.

Provided by Ecole Polytechnique Federale de Lausanne

Citation: Scientists develop new method for 'extremely' early cancer detection (2012, November 2) retrieved 6 May 2024 from https://medicalxpress.com/news/2012-11-scientists-method-extremely-early-cancer.html