Nanotechnology to provide portable genetic risk detection

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A state-of-the-art portable biosensing device based on micro- and nanotechnologies will empower doctors to rapidly and accurately forewarn patients of their genetic risk of developing diseases such as cancer.

Currently being developed by the IST project OPTONANOGEN, a prototype of the system will initially be used to detect mutations of the BRCA1 gene that are responsible for between 2.5 and 5 per cent of the incidence of breast cancer in women. The final system, however, could be used to detect virtually any genetic anomaly as well as proteins linked to viruses, chemical contamination in food or water pollution.

“There are a broad variety of applications for this system, although the main market is in biomedicine,” explains OPTONANOGEN coordinator Laura Lechuga at the National Microelectronics Centre (CNM) in Spain. “Though commercial biosensing systems exist they are larger and designed to be used in laboratories. We are the first to develop a fully integrated system on a small scale in this field.”

The final device will be roughly the size of a human hand, allowing it to be used in doctors’ surgeries to determine the genetic predisposition of a patient to certain diseases in a matter of minutes. That compares to the hours or even days it can take to carry out the same analysis in a laboratory, which is generally only used to test high risk groups such as women with a family history of breast cancer.

To detect genetic mutations the OPTONANOGEN system uses an array of 20 microcantilevers coated in nucleic acid that react when they come into contact with a DNA sample displaying the genetic anomaly. The sample is injected into the device via a microfluidic header and the deflection of the cantilevers – by as little as 0.1 to 0.5 nanometres – is picked up by a photodetector array based on the reflection of light off the cantilevers from Vertical Cavity Surface Emission Lasers (VCSELs).

“We’ve patented both the microcantilever set up and the optical detection system and we are due to take out a third patent on the microfluidic header, which is unique in that it uses individual inlet and outlet paths for each cantilever rather than one for the whole array, something that has never been achieved before,” Lechuga says.

The cantilever array and microfluidic header are due to be low-cost components that would be disposable if used for medical analysis but which could be cleansed and reused for other applications.

After evaluation trials later this year, a commercial variant of the system is likely to be produced within one or two years by Sensia, a 15-month-old spin-off company from the CNM.

Source: IST Results istresults.cordis.lu/