Announcements

IBM Scientists Use Lab-on-a-Chip Nanochannel Technology Designed to "Stretch" DNA to Help Detect Disease

ARMONK, N.Y., May 15, 2017 /PRNewswire/ -- IBM (NYSE: IBM) scientists have developed a "lab-on-a-chip" technology that can stretch double-stranded DNA molecules with the potential to efficiently reveal biomarkers that may indicate disease.

This technology complements the IBM Research's "lab-on-a-chip" nanoDLD technology which separates bioparticles, such as exosomes and which may also contain biomarkers for disease detection. The nanochannel technology, which uses an array of diamond shaped micropillars[1] to pre-stretch DNA from its coiled state, before being pushed through the chip's nanochannels, could allow medical professionals to detect the presence of genomic alterations in the DNA molecules.

DNA Stretching Video: https://www.youtube.com/watch?v=cQPMzc5n_4Q

Caption: *Fluorescent microscopy video of lambda-DNA molecules (~48,000 base pairs in length and labelled with a fluorescence dye), as they stretch, before they get linearized when they translocate through nanochannels of a width of 200 nm.*

Scientists have discovered[2] that certain genetic alterations, such as fusions of different parts of DNA, or an unusual amplification of the number of copies of certain genes, or a simple change in the DNA sequence can increase susceptibility to disease, or be the sign of a developing cancer. The challenge is detecting these alterations in DNA with affordable and easy to deploy technology. Today, medical labs can detect genomic alterations from patients' DNA samples, but it requires lengthy, expensive processing of DNA samples from a tissue biopsy or from blood.

Using standard silicon chip technology may enable the detection of these DNA alterations to be compact, more cost-effective and easier for mass production. IBM's goal is to integrate the fluidic chip with electronics that make it possible to transmit the data from the chip to datacenters for analysis. The long-term vision is that medical professionals could have a point-of-care device, packaged with the biochip, to conduct DNA testing that is then sent to the cloud for analysis. For example, the technology could be combined with cognitive tools such as Watson for Genomics or Watson Oncology to help detect the presence of DNA alterations, so doctors can propose treatment options tailored to their patients who have those mutations. As with all Watson technologies, the goal is to augment human intelligence. In this case, helping doctors make more informed decisions.

"Our goal is to help doctors realize the precision medicine paradigm through speeding up the analysis of DNA samples by generating more automated technology. To that end, we have developed research technology on a standard silicon chip, using standard CMOS wafer fabrication processes – to create our biochip," said Gustavo Stolovitzky, Program Director, IBM Translational Systems Biology and Nanobiotechnology, IBM Research.

"IBM Research has decades of investment in and deep expertise on semiconductor and fabrication technologies. We also have a unique infrastructure and skill sets to make devices with new functions, from manipulating lights to detecting molecules. This DNA biochip is one example of a successful demonstration of these capabilities and expertise at IBM Research in the era of Internet of Things (IoT)," said Qinghuang Lin, Program Manager, IBM IoT for Healthcare, IBM Research.

For more about the IBM Research technology, read the paper Wafer-Scale Integration of Sacrificial Nanofluidic Chips for Detecting and Manipulating Single DNA Molecules, published in *Nature Communications*' March 2016 issue.

1. Hydrodynamics of diamond-shaped gradient nanopillar arrays for effective DNA translocation into nanochannels – *ACS Nano*
2. Liquid biopsy: monitoring cancer-genetics in the blood – *Nature Clinical Oncology*

About IBM Research

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