Fully Integrated Lab-on-a-disc for Biomedical Applications

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Abstract

"Lab-on-a-chip" refers a device that integrates multiple functions on a small-sized chip, which could be achieved by using large-sized equipment and well-trained expert in regular laboratories. In this presentation, we will discuss our on-going research on "Lab-on-a-disc", which applies centrifugal force to pump fluid for biological and chemical analysis. It is advantageous because of the capability to integrate and automate all the process into a disc-shaped device with simple, size-reduced, and cost-efficient instrumentation. For the full integration and automation from the raw sample preparation to the final detection on a small-sized device, collaborative efforts among biologists, chemist, clinicians, and engineers are pre-requisite. We report various examples of fully integrated "lab-on-a-disc" for the biomedical applications such as pathogen specific DNA extraction to test infectious diseases, enzyme-linked immuno-sorbent assay (ELISA), simultaneous detection of blood chemistry and immunoassay, and multiplexed immunoassays starting from whole blood. Integration with microfluidic technology allows more precise control of fluids while also reducing the expensive reagent consumption, the required analysis time and possible handling errors. We believe these collaborative efforts will not only improve the performance of the point-of-care-diagnostic devices but also potentially have great impact on global healthcare.

Yoon-Kyoung Cho Yoon-Kyoung Cho is currently an associate professor in Biomedical Engineering at UNIST and a group leader in the Center for Soft and Living Matter at the Institute for Basic Science (IBS), Republic of Korea. She received her Ph.D. in Materials Science and Engineering from the University of Illinois at Urbana-Champaign in 1999, having obtained her M.S. and B.S. in Chemical Engineering from POSTECH in 1994 and 1992, respectively. She worked as a senior researcher (1999–2008) at Samsung Advanced Institute of Technology (SAIT), where she participated in the development of in vitro diagnostic devices for biomedical applications. Since she joined UNIST in 2008, she has been the chair of the school of Nano-Bioscience and Chemical Engineering (2008–2014) and the school of Life Sciences (2014–2015) and the director of World Class University (2009–2013) and BK21 (2013–2015) programs. Her research interests range from basic sciences to translational research in microfluidics and nanomedicine. Current research topics include a lab-on-a-disc for the detection of rare cells and biomarkers, quantitative analysis of single cells, and system analysis of cellular communication.