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Nanobiomedical device system for nanomedicine and innovative business

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A new paradigm of nanobiomedical devices has been exploited in areas such as combinational chemistry, biotechnology, engineering and clinical diagnostics. One of the critical issues in the nanobiomedical system is how to differentiate signal-to-noise (S/N) ratio per very small amount of signal for high sensitivity homogenous assays. Until now, we achieved high /specific detection of biomolecule using arrayed nanostructures (i.e., nanowells). The electrochemical (EC) nanowell array biosensors have significantly improved biomolecular detection by increasing sensitivity, limit of detection (LOD), S/N ratio, multi-targeting, and being label-free, compared to conventional micro sensors. The nanowell sensors have extremely low volume on the order of atto-liters (10-18 L) per well, and a total volume of approximately 32 femto-liters per sensor. Due to the geometrical constraints of nanowells, they can be designed to allow for the immobilization of only a few biomolecules. This leads to significant improvement of sensor sensitivity because it reduces potential aggregation and enhances the spatial orientation of the biomolecules compared with conventional electrodes with flat surfaces. Here I'll describe a demonstration of precious molecule recognition while maintaining the bioactivity on nanostructured space. We performed biosensing within nanowells for the EC detection of stress-induced-phosphoprotein-1 (STIP-1), a biomarker for ovarian cancer. The sensitivity of the nanowells impedimetric immunosensor was better for each analyte concentration tested when compared the sensitivity of the bare electrode sensor. The EC nanowell biosensor showed the 10 pg/mL LOD, which had 100-fold improvement compared with bare microelectrode. The developed miniaturized/integrated nanowell array-device system has shown excellent advantages over conventional instrumental systems for analysis of biomaterials in its size, cost, detection time and multiplex detection capability. I'll also present the relationship between particle uptake and distribution for TiO2 nanoparticles (NPs) and cosmeceutical-NPs modified with fatty acied (palmitoleic acid, palmitic acid, stearic acid, and oleic acids) in human fibroblast skin and adenocarcinoma lung cells for chemotherapy. Finally, I'll describe the plan to commercialize nanomedical device system for Fast, Easy-to-use, Accurate, and Low-cost (FEAL) personalized healthcare.

Biography

HeaYeon Lee, PhD, is President and CEO of Mara Nanotech New York, Inc., USA and a Visiting Professor at the Department of Pharmaceutical Sciences, Bouve College of Health Sciences, Northeastern University, Boston, MA. She received her BS (1987) and MS degrees (1990) in Chemistry from Pukyong National University, South Korea and her PhD degree (1995) in Chemistry from Osaka University, Japan. After finishing advanced degrees in nanofabrication and characterization technologies, she has been working on developing new nanobioelectronic devices and nanobiosensors. She was a Designated Professor at the Institute of Scientific and Industrial Research, Osaka University, and Research Associate Professor of Mechanical and Industrial Engineering at Northeastern University, Boston, USA. Her research work has been contributing to accelerating cutting-edge research in the emerging bio-nanoscience area.

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