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Micro and nano-sensing techniques for the diagnosis of bacteria and cells

A microfluidic device based on ionic current sensing system for high-throughput and practical single bacteria and mammalian cell sizing was developed and furthermore, discrimination of bacterial species and mammalian cell deformability was achieved. The highly precise sizing system based on blocking ionic current at narrow microchannel provided the information on antibiotic resistant strains of bacteria. Deformability changes associated with passage of adipose tissue-derived stem cells (ASCs) were also successfully detected by the device without any chemical or biological modification. The mechanical properties of a cell are extremely important because changes in the mechanical properties are indicative of diseases ranging from diabetes to malignant transformation. Considering the heterogeneity within a population of cancer cells and stem cells, a robust measurement system at the single cell level is required in both research and clinical situations. Recent developments in microfluidic devices have advanced the throughput of mechanophenotyping measurements. However,

since most of these assay techniques essentially rely on optical detection systems, the spatial resolution was limited to a few μm in the xy plane and less in the z direction. We have proposed the microfluidic device with two consecutive constrictions for a single cell sizing and deformability measurements based on blocking ion current. In this work, we validated the methodology and expanded the application field to stem cell research.

Speaker Biography

Noritada Kaji is a professor of the Graduate School of Engineering at Kyushu University, Japan. He obtained a bachelor's degree in Pharmaceutical Sciences in 2000 and PhD degree in 2004 from the University of Tokushima, Japan. In his PhD study, he developed nanopillar chips that were a state-of-the-art μTAS combined with nano-fabricated structures for DNA analysis. After his postdoctoral research, he started working as an assistant professor of the Department of Applied Chemistry at Nagoya University from February 2005 and promoted as an associate professor from November 2011. He became a full professor of Department of Applied Chemistry at Kyushu University from January 2018. His current research interests are mainly divided into the following parts; Development of micro and nanofluidic for single molecule biophysics and molecular biology, integration of whole biological processes on a single chip for systems biology.

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