Lecture by Philippe Renaud

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Dielectric spectroscopy for flow cytometry and cell-based screening

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Dielectric spectroscopy is a powerful tool for label-free analysis and characterization of biological cells. Impedance spectroscopy can be applied in single cell analysis or cell-based assays.

Here we present a microfluidic flow-cytometer capable of measuring the spectral impedance of individual cells as well as discriminating between cell types according to their dielectric properties. Alternatively, a continuous cell sorter based on the opposition of a combination of several dielectrophoretic forces at multiple frequencies has been built. The dielectric properties of the cells can be reconstructed from the position of the particle stream after the active element.

We also developed a microfluidic platform for label-free drug toxicity screening. Impedance spectroscopy can discriminate non-lethal morphological changes from cellular death in a continuous cell culture. We have applied this method to for toxicology screening of HepG2/C3A cells exposed to time dependent concentration of acetaminophen. Perfusion of repeated doses revealed altered dielectric properties of the cell culture after recovery from AP exposure. Same platform was used for monitoring of drug induced cellular changes in cancer cell culture. This study highlights the possibility to assess drug efficacy and drug response providing continuous information regarding cell-drug interaction.

Ph. Renaud short biography

Philippe Renaud, PhD. in physics. Postdoctoral researcher at University of California, Berkeley and then at the IBM Zürich Research Laboratory in Switzerland (1990-91). In 1992, joined CSEM, MEMS sensors team in Neuchâtel, Switzerland. In 1993, assistant professor at EPFL and part-time at CSEM. In 1996, visiting professor at the Tohoku University, Japan. Appointed as full professor in 1997. Since 1998, director of the EPFL Center of MicroNanoTechnology (CMI).

Research interests:

BioMEMS technologies and applications, biomedical devices, nanofluidics

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