Lab-On-Chip platform for neutralization of cancer stem cells

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Abstract

The SUMCASTEC project aims to isolate and neutralise brain cancer stem-like cells (CSC) using electromagnetic stimulation1. We present the first results on neutralization of CSCs using a compact lab-onchip (LOC) in various cell throughput and field amplitude conditions.

Presented Work

Treatment of CSCs has been recently proposed using in a conventional cuvette applicator and a dedicated nanosecond pulse generator to induce electro-permeabilization of the targeted cells. While this approach is suitable for stimulation of the relatively high number of suspended cells that fit in the gap of standard electroporation cuvettes – of the order of 1 mm – it requires application of high electric fields to ensure CSCs neutralization. Such condition typically imposes the utilization of bulky and/or high-end voltage sources, while impairing electrical impedance and microenvironment control on the applicator side.
An ultracompact LOC module was developed basing on Bi-CMOS technology and electrode gaps of 50 um that were integrated with a microfluidic cell delivery system and an in-house pulse source. The LOC enabled U87 CSCs exposure and fluorescent die staining while routing them to an off-chip reservoir for permeabilization and viability monitoring. A parametric study of cell throughput and minimum field amplitude for on-chip electro-permeabilization is discussed.
This study underpins the development of even more compact, or portable setups with the potential for enhanced and critically needed[3] control of stem cell microenvironment conditions.

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