Multichannel Bipotentiostat Integrated With a Microfluidic Platform for Electrochemical Real-Time Monitoring of Cell Cultures

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An electrochemical detection system specifically designed for multi-parameter real-time monitoring of stem cell culturing/differentiation in a microfluidic system is presented. It is composed of a very compact 24-channel electronic board, compatible with arrays of microelectrodes and coupled to a microfluidic cell culture system. A versatile data acquisition software enables performing amperometry, cyclic voltammetry and impedance spectroscopy in each of the 12 independent chambers over a 100 kHz bandwidth with current resolution down to 5 pA for 100 ms measuring time. The design of the platform, its realization and experimental characterization are reported, with emphasis on the analysis of impact of input capacitance (i.e., microelectrode size) and microfluidic pump operation on current noise. Programmable sequences of successive injections of analytes (ferricyanide and dopamine) and rinsing buffer solution as well as the impedimetric continuous tracking for seven days of the proliferation of a colony of PC12 cells are successfully demonstrated.

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