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Design of a Petri-like culture platform for controlled electrical cell conditioning *in vitro*

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In vitro cardiac tissue engineering often involves the use of bioreactors where multivariate combinations of stimuli are applied, in an attempt to mimic the physiological environment. In a context where bioreactors of increasing complexity are being developed, understanding the role of each biophysical cue is still at the core of basic studies on stem cell differentiation. There is hence a need for simple, reliable and user-friendly laboratory devices designed for cell culture studies under strictly controlled biophysical conditions. We have developed an easy-to-use, cost-effective cell culture platform, able to provide controlled electrical stimulation, to permit investigating the influence of the electric field in stem cell differentiation process. The bioreactor consists of an electrical stimulator driving twelve petri-like culture chambers. Chambers are completely independent thanks to a module-on-board layout, with a simple *plug-in* conception. A 3-D computational FEM model was used to characterize the distribution and intensity of the electric field generated in the cell culture volume in electroquasistatic conditions, as a function of the culture medium volume filling the chamber. The time course of the voltage inside the culture medium was characterized experimentally for monophasic (8V, 2ms, 1Hz) and biphasic (+4V, 1ms and -4V, 1ms; 1Hz) square pulse stimulation waveforms.