Title: A New Optical Tool to Combine Optical and Electrical Analysis in Neuronal Drug Screening.

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Abstract

Since their introduction 30 years ago, Micro-Electrode Arrays (MEAs) have been exploited as devices providing distributed information about learning, memory and information processing in a cultured neuronal network, thus changing the field of view from the scale of the single cell (glass pipettes) to the scale of the complex network properties. MEAs represent a growing technology for the study of the functional activity of neuronal networks in a large-scale view providing the possibility (a) to gain information about the spatio-temporal dynamics of the neuronal network, (b) to allow recordings of electrical activity over periods of time not compatible with conventional electrodes and (c) to monitor network activity at several sites in parallel. More recently, according to the trend aimed at the reduction of animal tests, MEAs have been exploited as in vitro biosensors to monitor both acute and chronic effects of drugs and toxins on neuronal networks in physiological or pathophysiological conditions. Now, optical methods for neuronal stimulation, e.g. using caged compounds, represent an useful tools to overcome the limits affecting the MEA technology.
Here, local light stimulations were obtained switching caged glutamate in the active form by UV light pulses using optical fibres exactly aligned at the MEA electrodes. This approach allows us to activate the network or to delivery other active compounds in specific regions of the network and to monitor their effects on the overall network functioning. Combining these two optical (stimulation) and electrical (detection) methods a micro-scale approach (stimulation) meets a large-scale approach (detection). This methodology may turn out to be extremely useful for testing the ability of drugs and toxins to affect neuronal properties as well as alterations in inter- and intra-neuronal communication. In this frame, a patent was registered for this novel optoelectronic technological solution for the study of the neuronal activity in culture, in order to understand the physiological and pathological functioning of neuronal networks.

Biography

Diego Ghezzi has a Master degree in Biomedical Engineering from the Politecnico di Milano in 2004 and now he is attending his PhD in Bioengineering (grant of the Italian Institute of Technology). His research starting studying optical devices to stimulate and to detect the activity of in-vitro cultured neurons.

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