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Research Article

Simultaneous multisite detection of quantal release from PC12 cells using micro graphitic-diamond multi electrode arrays

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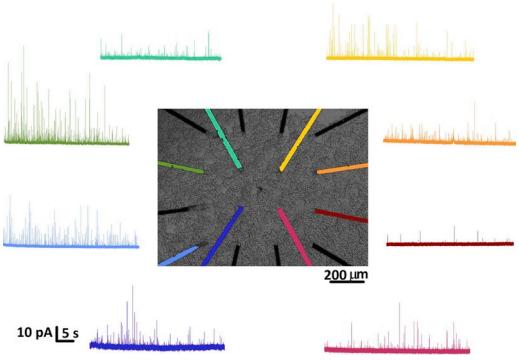
HIGHLIGHTS

- Simultaneous multisite amperometric recording by menas of diamond based MEA sensors
- PC12 secretion modulation through L-DOPA administration
- Evaluation of exocytotic spikes parameters before and after drug injection

GRAPHICAL ABSTRACT



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ABSTRACT

Micro graphitic – diamond – multi electrode arrays (µG-D-MEAs) are suitable for measuring multisite quantal dopamine (DA) release from PC12 cells. Following cell stimulation with high extracellular KCl and electrode polarization at +650 mV, amperometric spikes are detected with a mean frequency of 0.60 ± 0.16 Hz. In each recording, simultaneous detection of secretory events is occurred in approximately 50% of the electrodes. Kinetic spike parameters and background noise are preserved among the different electrodes. Comparing the amperometric spikes recorder under control conditions with those recorders from PC12 cells previously incubated for 30 min with the dopamine precursor Levodopa (L-DOPA, 20 µM) it appears that the quantal size of amperometric spikes is increased by 250% and the half-time width ($t_{1/2}$) by over 120%. On the contrary, L-DOPA has no effect on the frequency of secretory events.

Overall, these data demonstrate that the µG-D-MEAs represent a reliable bio-sensor to simultaneously monitor quantal exocytotic events from different cells and in perspective can be exploited as a drug-screening tool.

1. Introduction

Vesicular exocytosis, i.e. the fusion of a secretory vesicle with the plasma membrane, is a key process regulating synaptic transmission. Both in neurons and neuroendocrine cells, Ca^{2+}-dependent exocytosis requires that small synaptic vesicles (or dense core vesicles) undergo a

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