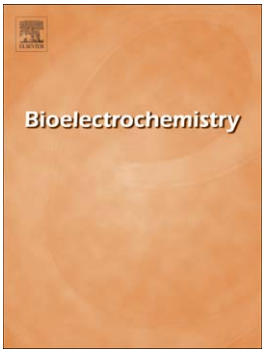

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Adrenal chromaffin cells do not swell when exposed to nanosecond electric pulses

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ABSTRACT

High intensity, nanosecond duration electric pulses (NEPs) permeabilize plasma membranes causing osmotic cell swelling that can elicit a wide variety of cellular effects. This study examined the possibility that cell swelling is the mechanism by which 5 ns NEPs trigger the release of catecholamines from neuroendocrine adrenal chromaffin cells. Swelling was assessed by comparing measurements of cell area obtained from bright field images of the cells before and at 10 s intervals following exposure of the cells to 5 ns pulses at a field intensity of 5–6 MV/m. The results indicated that chromaffin cells do not swell in response to a single pulse or a train of ten pulses delivered at repetition frequencies of 10 Hz and 1 kHz. Swelling was also not observed in response to a train of 50 pulses whereas Jurkat T lymphoblast cell area increased 15% on average under the same NEP exposure conditions. These results demonstrating that chromaffin cells do not undergo swelling when exposed to 5 ns NEPs have important implications regarding the mechanism by which these pulses stimulate the release of catecholamines from these cells, namely that catecholamine secretion is most likely not caused by cell swelling.

Key Words: nanosecond pulse, membrane permeabilization, chromaffin cells, Jurkat cells, cell swelling