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Presentation Abstract

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Abstract: From its introduction, in utero electroporation has arisen as a powerful tool to manipulate neural-precursor cells of the parietal cortex and their progeny in vivo. Although this technique has unlimited potentials for targeting numerous brain areas, the experimental outcome appears to have been hindered so far by low reliability of transfection in some brain regions and by the inability to target other regions. Here, we validate a new in utero electroporation design based on the use of three electrodes. Due to the new layout, the proposed approach enables a more proper positioning of the electrodes and overcomes the physical limitations of the common bipolar configuration. Therefore, this solution allows for exceedingly reliable transfection at different brain locations only sporadically targeted before: by simply adjusting the relative positions and polarities of the three electrodes, hippocampus, motor cortex and visual cortex were targeted with extremely high consistency. Supporting these experimental findings, we provided a mathematical simulation of the 3D distribution of the electric field across the embryo brain showing increased efficacy, consistent with the improvement obtained in the efficiency of transfection. Moreover, we present here peculiar data revealing the strength of the proposed in utero electroporation approach in obtaining bilateral and symmetric transfection patterns with a single electroporation step. Finally, the proposed multi-

electrode configuration, in virtue of the increased efficacy of the electrical field distribution also allowed extension of the developmental timeframe for reliable electroporation, succeeding for the first time in specific transfection of Purkinje cells in the cerebellum. In conclusion, the proposed configuration offers a conceptual advance in the in utero electroporation technique that will further thrust the experimental frontiers paving the way to targeting new brain areas by simply varying the number, together with the polarities, of the electrodes.

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hippocampus, cerebellum, visual and motor cortex

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