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Static Magnetic Field Exposure *In Vivo* Enhances the Generation of New Doublecortin-expressing Cells in the Sub-ventricular Zone and Neocortex of Adult Rats

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Abstract—Static magnetic field (SMF) is gaining interest as a potential technique for modulating CNS neuronal activity. Previous studies have shown a pro-neurogenic effect of short periods of extremely low frequency pulsatile magnetic fields (PMF) *in vivo* and pro-survival effect of low intensity SMF in cultured neurons *in vitro*, but little is known about the *in vivo* effects of low to moderate intensity SMF on brain functions. We investigated the effect of continuously-applied SMF on subventricular zone (SVZ) neurogenesis and immature doublecortin (DCX)-expressing cells in the neocortex of young adult rats and in primary cultures of cortical neurons *in vitro*. A small (3 mm diameter) magnetic disc was implanted on the skull of rats at bregma, producing an average field strength of 4.3 mT at SVZ and 12.9 mT at inner neocortex. Levels of proliferation of SVZ stem cells were determined by 5-ethynyl-2′-deoxyuridine (EdU) labelling, and early neuronal phenotype development was determined by expression of doublecortin (DCX). To determine the effect of SMF on neurogenesis in vitro, permanent magnets were placed beneath the culture dishes. We found that low intensity SMF exposure enhances cell proliferation in SVZ and new DCX-expressing cells in neocortical regions of young adult rats. In primary cortical neuronal cultures, SMF exposure increased the expression of newly generated cells co-labelled with EdU and DCX or the mature neuronal marker NeuN, while activating a set of pro neuronal bHLH genes. SMF exposure has potential for treatment of neurodegenerative disease and conditions such as CNS trauma and affective disorders in which increased neurogenesis is desirable.

Key words: static magnetic field, neurogenesis, sub-ventricular zone, neocortex, primary neuronal culture.