FOS PROTEIN IN MEDIATION OF STRESS RESPONSE INDUCED BY SINGLE SHORT-TERM MATERNAL SEPARATION IN OLFACTORY NEUROGENIC AREAS

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Adverse effect of repeated separation of rat pups from their mother on processes of neurogenesis has been previously described. However, the influence of single short-term maternal separation (MS) on neurogenesis has not been studied yet. The aim of this work was to assess the effect of this stressful event on neurogenesis of neonatal rats and to elaborate the possible role of Fos protein in mediating the stress response induced by separation. We have investigated Fos expression in cells of neurogenic areas: the subventricular zone (SVZ), rostral migratory stream (RMS) and in the olfactory structures: the olfactory bulb (OB), accessory olfactory bulb (AOB) and the anterior olfactory nucleus (AON).
Rat pups were exposed to single separation from the mother on postnatal day 7 (P7), 14 (P14) and 21 (P21) for 2 hours and immediately transcardially perfused. Fos immunopositive cells were quantified in the SVZ, RMS, OB, AOB and in the AON. To reveal whether newborn cells produce Fos protein, pups were injected by BrdU 10 days before maternal separation at P21 and double immunohistochemistal labeling for Fos and BrdU was performed.
There were no Fos+ cells neither in the SVZ of P7 and P14 control nor experimental animals. In the SVZ of P21 control rats a few Fos+ cells were observed and exposure to MS significantly increased their number. In the RMS of P7, P14 and P21 control rats were no Fos+ cells and separation from the mother didn't induce Fos expression in any experimental rat. MS induced notable changes in production of Fos protein in all examined olfactory areas. The number of Fos+ cells was increased in all OB layers. Increased number of Fos+ cells after MS was observed in AOB layers of P14 rats, where MS also induced early production of Fos protein in glomerular, nerve and granular layer. In the AON, the enhancement of Fos protein expression induced by MS was age dependent. BrdU+ cells did not colocalized with Fos+ cells in any assessed areas.
Our results suggest that some SVZ cells have complete precondition requisite for the Fos signal transduction and they are unlike RMS included in circuitry activated by MS. We can conclude that the AOB can be activated besides pheromone-like chemo-signal also by MS. Our finding also indicates that stress due to MS can induce Fos protein production in cells, which don't produce this protein under physiological conditions. The absence of colocalization of Brdu and Fos in all examined regions indicates that 10 day period after BrdU administration isn't long enough to provide the evidence about functional significance of newly born cells. Activation of important olfactory centers, the OB and AON indicates that single short-term maternal separation is a stressful signal which is mediated by olfaction.

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