

Effect of maternal care and chronic stress on neuronal plasticity in the rat hippocampus induced by maternal separation

M.C. Mostallino¹, V.M. Melis², F. Biggio², M. Serra², G. Biggio²

¹Institute of Neuroscience, National Research Council, CNR, Monserrato, Italy

²Dept. of Life and Environment Sciences, section Neurosci., Univ. of Cagliari, Cagliari, Italy

Behavioral studies in rodents have shown that changes in the environment, in different periods of life, can lead to profound and lasting effects on neuronal plasticity as reflected by increased vulnerability or resilience to stress. Stress in the first two weeks of life is particularly harmful for the physiological development of the brain. The goal of our study was to verify if stress induced by insufficient maternal care in the first 15 days of life increased the vulnerability to chronic stress conditions in adulthood. In this research, we used two experimental protocols of maternal separation, every day from the 3rd to day 15th after the birth: a) one group of pups was separated from their mothers for 15 min, b) pups from the second group were separated for 3h. At weaning half of the rats belonging to the different groups was isolated for 60 days, while the remaining rats were isolated for 30 days then re-grouped for following 30 days. The results obtained were compared with those of rats never separated from their mothers (control), but subjected or not to social isolation. After sacrifice we studied the density and morphology of dendritic spines, the arborization dendritic tree and neurogenesis in the hippocampus. The results obtained showed that social isolation induced a reduction of the complexity of the dendritic tree, variation of the morphology and density of the dendritic spines, and a reduction of neurogenesis in both animals not separated from the mother and in the separated ones. In rats re-grouped after a month of isolation stress the morphology and density of dendritic spines, arborization dendritic tree and the neurogenesis were completely reverted when compared to animals that have never been separated from their mothers. In contrast, in animals subjected to maternal separation for 3 h the social enrichment (re-grouped) failed to revert the effects of isolation stress. In rats exposed to maternal separation for 15 min, social isolation for 60 days did not induce any change in the parameters studied. These results demonstrate that a short (15 min) maternal separation of the animals in the first 15 days of life makes them more resilient to chronic stress during the first 80 days. The data suggest that the most intense maternal care resulting from a brief separation leads to a more enduring resilience to stress that persists during adulthood. On the contrary, 3h stress/day which results in lower maternal care predicts increased vulnerability to psychopathology with impaired neuronal plasticity at the level of emotional, cognitive and affective brain areas.

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