

Aging, cognitive decline and reduction of the number of astrocytes in the molecular and granular layers of the dentate gyrus

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Stereological estimation of glial cell numbers in dentate gyrus (DG) were not correlated with aged behavioral changes. Possible correlation between the number of astrocytes in DG and behavioral changes are investigated in aged C57Bl6 mice. Young (6 months old, n = 6) and aged (24 months old, n = 5) female C57Bl6 mice were submitted to Y maze, non-match-to place spatial memory, and open field (OF) tests. Video recorded was analyzed with ANYMAZE tracking system (Stölting Science). Threshold for statistical significance was set at $p < 0.05$. After behavioral tests, subjects were sacrificed and brain sections were immunolabeled for glial fibrillary acid protein (GFAP). Regions of interest and cell counting on each layer were stored and analyzed by optical fractionator (Stereoinvestigator® (MicroBrightField, Willston, VT, USA). It was detected a significant reduction of the number of astrocytes in the granular (12052.77 ± 1360.42) and molecular layers (32673.54 ± 3473.41) and in DG total counts (66017.45 ± 4998.86) in senile subjects, when compared with young individuals (16523.93 ± 649.28 ; 43552.10 ± 1506.65 ; 85097.77 ± 3162.73 , t-Student test, $p < 0.05$). Familiar from new arms of Y maze, and displaced from stationary objects in the spatial memory tests, could not be distinguished by aged subjects ($p > 0.05$). Locomotor and exploratory activity were reduced in OF measured as distance traveled ($1.44 \text{ m} \pm 0.36$), mean speed ($0.48 \text{ cm/s} \pm 0.12$) and immobile time ($273.85 \text{ s} \pm 5.76$) in senile subjects in comparison with young ones ($4.23 \text{ m} \pm 0.69$; $1.43 \text{ cm/s} \pm 0.22$; 219.98 ± 13.20 , ANOVA, bonferroni a priori, $p < 0.05$). The number of entries in the new arm of Y maze and the number of astrocytes of granular layer were correlated (Pearson, $R^2 = 0.5785$, $p = 0.0284$), molecular $R^2 = 0.7698$, $p = 0.0042$) and with total DG counts ($R^2 = 0.7373$, $p = 0.0063$). Traveled distance in the new arm of Y maze and the number of astrocytes of granular ($R^2 = 0.7039$, $p = 0.0092$), molecular $R^2 = 0.6588$, $p = 0.0144$), and of the dentate gyrus total counts ($R^2 = 0.7219$, $p = 0.0075$) shown good correlation. The reduction of the number of astrocytes in DG and cognitive decline in aged C57Bl6 mice seem to be interdependent.

Keywords: astrocytes, aging, cognition, dentate gyrus, mouse.

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