CA3 perineuronal nets, aging and cognitive decline in C57BL/6 mice

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The integrity of perineuronal (PN) nets seems to be essential for synaptic plasticity and CA3 is a key structure in the hippocampal network. No reports have investigated possible relations between aged cognitive decline and altered PN nets in CA3. The aim of the present report is to estimate by stereological method the number of PN nets in aged mice CA3 and investigate possible correlations between recognition on spatial, temporal and object memories. Eight C57Bl/6 mice 6 (young Y, n = 4) and 20 months old (aged A n = 4) were housed in standard cages with ad libitum regime of food and water, 12h dark/light cycle and tested. Video recorded tests were analyzed with ANY-maze tracking system (Stöelting). All subjects were tested in isolated tests for non-matched to sample, placed, temporal and object memories and sacrificed. After perfusion with aldehyde fixatives, brain was removed, cut and processed for Wisteria Floribunda histochemistry. Stereological investigation was done by optical fractionator (StereoInvestigator® MicroBrightField, Willston, VT, USA). Hippocampal fields were conspicuously delimited by lectin labeling. Oriens, pyramidal and stratum lucidum layers of CA3 present two dense PN net populations of lectin labeled cells: Type I and Type II. Type I present soma, proximal and distal labeled dendrites and Type II only somatic PN nets with very short and faint primary dendrites. The number of both types of cells were estimated and total numbers were similar in both groups (A = 1133.33 ± 71.65; Y = 943.69 ± 148.12 - ANOVA $p > 0.05$) but the proportion and absolute numbers between Type I and Type II PN nets changed significantly: Type II estimation in aged mice was much higher (716.97 ± 94.75) than Type I (396.37 ± 44.47 - ANOVA $p < 0.025$) whereas no difference was found in young mice (Type I = 529.87 ± 94.07; Type II = 413.82 ± 80.56; ANOVA $p > 0.05$). Aged mice present as expected significant worse performances than young ones in all tests: they were not able to recognize spatial, temporal and object identities. Since the integrity of PN nets is essential to synaptic plasticity we suggest that aged detected changes in PN nets may be associated with cognitive decline.

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