Ongoing Myelination in the Hippocampus of the Adult Mouse

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Ongoing adult myelination of axons might be a marker for brain regions specifically modulating the cognitive and behavioral changes during the entire life span. Thus, we have assessed, by means of the Gallyas silver impregnation method, the density of stained fibers and the myelination patterns in various regions of the mouse brain throughout life. The regions of interest (ROI) included fiber tracts (optic tract, internal capsule, corpus callosum, perforant pathway, fimbria hippocampi), and cell fields (cingulate cortex, hilus of the dentate gyrus, stratum oriens of CA3 and the pyramidal layer of CA1). The mice were F1 hybrids (D2B6) from the same parents; five age cohorts of littermates (consisting of 8-10 mice of both sexes) were sacrificed at day 40 (subadult), day 80 (young adult), day 160 and 320 (adult) and day 640 (senile). A normalized staining index was computed from the absorption range of the cerebellar molecular layer (no myelinated fibers) to the corpus callosum (intensely myelinated).
No quantitative changes across age groups were observed for the fimbria hippocampi and the cingulate cortex. The optic tract and the internal capsule showed a slight but significant increase in the senile mice. The hilus of the dentate gyrus, CA3, CA1 and the perforant pathway revealed a significant and fairly linear increase from days 40 to 640, most visibly in hippocampal subfield CA1. In those regions with significant alterations, females often showed significantly reduced (about 10%) density of myelination.
These data indicate region-specific late maturation of axonal connections in the mouse hippocampus, probably related to enhanced processing speed of established connections. Since such myelination inhibits axon growth, the increase of processing speed might be associated with a reduction in synaptic plasticity. Thus, late myelination might form one of the mechanisms by which acquired behavioral habits are stabilized in adulthood, preserving such behavior even against the degenerative changes associated with senescence.

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