



Ongoing myelination in the hippocampus of the adult mouse

156.12 p69

D.P. Wolfer, M. Vich-Plesko, H.-P. Lipp, Institute of Anatomy, University of Zürich

Supp. by SNF 31-37497.93 & 31-46691.96

Introduction

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.

Conclusion

Our 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, potentially preserving such behavior even against the degenerative changes associated with senescence.

Methods

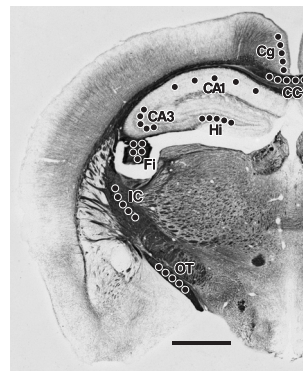
5 age cohorts (D2B6F1 littermates, 8-10 mice of both sexes) sacrificed at day 40 (subadult), day 80 (young adult), day 160 and 320 (adult) and day 640 (senile). Regions of interest: fiber tracts (optic tract, internal capsule, corpus callosum, perforant pathway, fimbria hippocampi), cell fields (cingulate cortex, hilus of the dentate gyrus, stratum oriens of CA3, pyramidal layer of CA1). Normalized staining index computed as shown in box from absorption range between cerebellar molecular layer (no myelinated fibers) to corpus callosum (intensely myelinated). Bar in Fig. 1mm.

$$SROI = LCBL - LROI$$

$$IROI = \frac{LROI - LCBL}{LCC - LCBL}$$

L = raw level (0=black, 255=white)
S = corrected staining level, max=255
I = normalized staining index, max=1.0

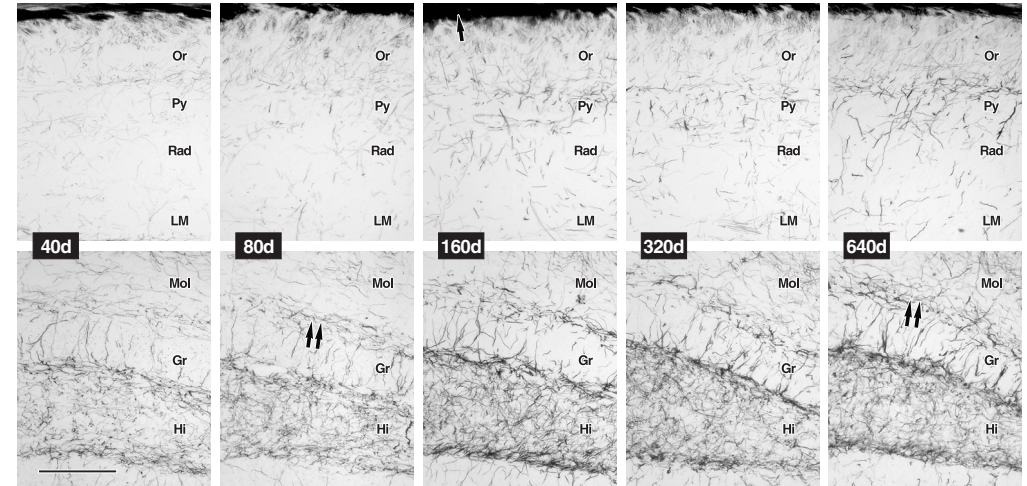
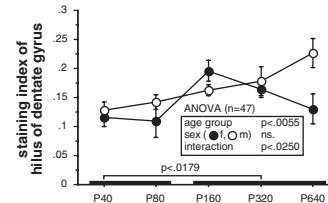
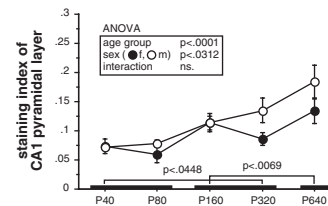
ROI = region of interest
CBL = cerebellar molecular layer
CC = corpus callosum



Abbreviations

CA1/3 fields of Ammon's horn, CC corpus callosum, Cg cingulate cortex, Fi fimbria hippocampi, Gr granular layer, HI hilus, IC internal capsule, LM stratum lacunosum moleculare, Mol molecular layer, Or stratum oriens, OT optic tract, Py pyramidal layer, Rad stratum radiatum.

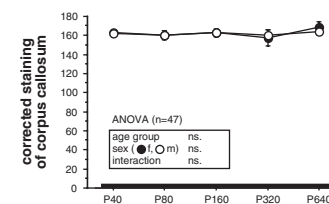
Myelination continues in adult dentate gyrus and Ammon's horn



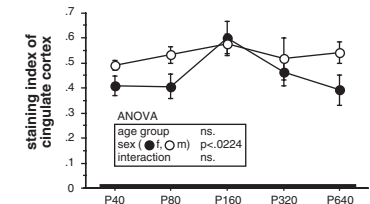
Plots show means and standard errors of normalized myelin staining indices in Gallyas silver-stained sections. P-values placed along the horizontal axis indicate individual group differences as detected by Fisher's LSD-test. Groups which could not be distinguished by Fisher's LSD-test are joined by black horizontal bars. Changes in CA3 are similar to CA1 (not shown).

Photographs are detail views of CA1 region (upper bank) and dentate gyrus (lower bank) taken from individuals whose relative myelin staining index was closest to the mean of the respective cohort. Double arrows: supragranular plexus, single arrow: alveus with maximal myelin density. Bar = 100µm.

Changes are restricted to hippocampus



Means, standard errors and two-way ANOVA of background corrected staining levels in the corpus callosum. No age or sex differences.



Normalized myelin staining index in layer 2 of cingulate cortex. No age effect despite submaximal staining, overall more staining in males.