EPENDYMIN, A SECRETORY CELL ADHESION MOLECULE INVOLVED IN NEURONAL REGENERATION AND BEHAVIOURAL PLASTICITY IN THE TELEOST CNS

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Lower vertebrates retain the ability to regenerate tracts in the adult central nervous system (CNS), a feature that is lost in higher vertebrates after embryonic life. Similar to migrating neurectodermal cells in early ontogenesis, axons are guided by adhesion molecules in cell membranes and the extracellular matrix. The cerebrospinal and interstitial brain fluids of lower vertebrates are particularly rich in glycoproteins. Ependymin is such a characteristic constituent of the teleost CNS. In periods of synaptogenesis during ontogenetic development and regeneration of the retinotectal projection ependymin is expressed and secreted in high concentration. Two N-glycosylation sites in its primary structure provide a basis for mono- and bi-N-glycosylated monomers. Depending on the calcium and zinc cation concentration of the medium, ependymin also forms dimers and polymers. It carries the L2/HNK-1 cell adhesion epitope in its carbohydrate chains and provides a good substrate for the adhesion of elongating retinal ganglion cell axons in vitro. In situ hybridization experiments revealed that ependymin is specifically synthesized in endomeningeal reticular shaped cells, pointing towards a much more prominent role of the meninx for development and regeneration of the CNS than hitherto anticipated. Ependymin mRNA is rapidly induced after active shock avoidance conditioning of goldfish. Following its secretion, the protein is redistributed and incorporated into radial glial cells and specific neuronal populations of the optic tectum. Both, sharpening of receptive fields during retinotectal regeneration and the formation of a long-term memory after behavioural conditioning are inhibited if this secreted cell adhesion molecule is inactivated by intracerebroventricular injection of anti-ependymin antibodies. Our results support the conclusion that some of the cell adhesion mechanisms implicated in development and regeneration of the CNS are also involved in behavioural neuroplasticity (Supported by the DFG, Schm 478/4-4).