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Subunit glutamate receptor expression in the white matter of the developing mouse brain.

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AMPA/kainate receptor mechanisms have been implicated in white matter injury. However, knowledge about glutamate receptor subunit localization in white matter is incomplete. We therefore examined the distribution of the kainate-selective glutamate receptor subunit, GluR5, in the postnatal mice corpus callosum using immunocytochemistry by confocal laser scanning fluorescence microscopy.

Experiments were performed on mice ranging from embryonic day E15 to adult. Animals were anaesthetized and perfused transcardially and their brains fixed thereafter. Embryos were anesthetized with halothane, and removed from the uterus, and the brains dissected and fixed. Coronal and sagittal sections (16 μm) were prepared by cryostat. For GluR5 expression, sections were processed using the avidin-biotinylated peroxidase complex method. For GluR5 co-localization with different cell markers, double-labeling was performed using Cy3 and Alexa Fluro 488-conjugated IgG.

From embryonic day (E)15 to early postnatal ages (P0 to P5), numerous GluR5-immuno reactive (IR) positive fibers were found throughout the brain, including the corpus callosum. These GluR5-IR fibers were labeled by nestin and RC2 antibodies. At P10, GluR5-IR dramatically decreased in nerve fibers and also became positive in glial cells in the corpus callosum. These GluR5-IR glial cells were labeled by the oligodendrocyte marker, anti-APC. GluR5 became progressively concentrated in the glial cells and less concentrated in the fibers thereafter. During the third postnatal week, GluR5 was most concentrated in oligodendrocytes and there was no GluR5-IR in the nerve fibers. GluR5 was widely expressed in oligodendrocytes until P32, but the intensity and the number of cells decreased. By P42 there were a few GluR5-IR glial cells in the corpus callosum. GluR5 was found to be expressed together with nestin-IR and RC2-IR fibers in the developing brain before and during the period of myelination in the corpus callosum (which begins around P11). These GluR5 fibers may be processes of radial glial cells or of newly formed neurons and the functional significance of this observation needs further investigation. Around P11, GluR5 expression shifts to oligodendrocytes. The dynamic upregulation of GluR5 during the postnatal period may contribute to white matter development and may influence the vulnerability of developing white matter to excitotoxic insults.