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A light and electron microscopic study of NG2 chondroitin sulfate proteoglycan-positive oligodendrocyte precursor cells in the normal and kainate-lesioned rat hippocampus.

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Abstract
The adult brain contains a large population of oligodendrocyte precursor cells that can be identified using antibodies against the NG2 chondroitin sulfate proteoglycan. The functions of this newly recognized class of glial cells in the normal or pathological brain are not well understood. To begin to elucidate these functions, we have examined the morphology and distribution of oligodendrocyte precursor cells in the hippocampus and neocortex of normal and kainate-lesioned rats by anti-NG2 immunocytochemistry using light and electron microscopy. Large numbers of oligodendrocyte precursor cells were present in all layers of the neocortex and hippocampus. These cells differed in their morphology from astrocytes, oligodendrocytes and microglia. The processes of these cells often surrounded unlabeled areas of clear cytoplasm. At the electron microscopic level, some of the profiles that were enclosed by oligodendrocyte precursor cell processes contained synaptic vesicles. Other enclosed profiles were dendrites or dendritic spines. NG2-immunopositive processes were also observed to interpose between axon terminals containing round vesicles and dendrites with thick postsynaptic densities. After kainate injection, the NG2-positive oligodendrocyte precursor cells in the hippocampus displayed reactive changes characterized by swollen cell bodies, an increased number of small, filopodial-like processes, and higher levels of immunodetectable NG2. Both viable and degenerating oligodendrocyte precursor cells were observed with electron microscopy. These observations emphasize the dynamic nature of the oligodendrocyte precursor cell and suggest that, in addition to participating in the glial reactions to excitotoxic damage, oligodendrocyte precursor cells may regulate the stability, structure and function of synapses in the normal central nervous system.

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