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Oligodendrocyte Precursor Cells from Different Brain Regions Express Divergent Properties Consistent with the Differing Time Courses of Myelination in These Regions

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Abstract

Different CNS regions exhibit different temporal patterns of oligodendrocyte generation and myelinogenesis. Characterization of oligodendrocyte-type-2 astrocyte progenitor cells (here abbreviated as O-2A/OPCs) isolated from different regions indicates these developmental patterns are consistent with properties of the specific O-2A/OPCs resident in each region. Marked differences were seen in self-renewal and differentiation characteristics of O-2A/OPCs isolated from cortex, optic nerve and optic chiasm. In conditions where optic nerve-derived O-2A/OPCs generated oligodendrocytes within 2 days, oligodendrocytes arose from chiasm-derived cells after 5 days and from cortical O-2A/OPCs only after 7–10 days. These differences, which appear to be cell-intrinsic (and may be related to intracellular redox state), were manifested both in reduced percentages of clones producing oligodendrocytes and in a lesser representation of oligodendrocytes in individual clones. In addition, responsiveness of optic nerve-, chiasm- and cortex-derived O-2A/OPCs to thyroid hormone (TH) and ciliary neurotrophic factor (CNTF), well-characterized inducers of oligodendrocyte generation, was inversely related to the extent of self-renewal observed in basal division conditions. Our results demonstrate hitherto unrecognized complexities among the precursor cells thought to be the immediate ancestors of oligodendrocytes, and suggest that the properties of these different populations may contribute to the diverse time courses of myelination in different CNS regions.

Keywords

myelination; development; oligodendrocyte-type-2 astrocyte progenitor; oligodendrocyte precursor cell; oligodendrocyte; self-renewal; precursor cell

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