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SKOFF, R.P. and D.L. PRICE, Department of Neurology, Johns Hopkins University, Baltimore, Md., 21205 [^{3}H]-Thymidine determination of neuroglial origin in rat optic nerve: a light and electron microscopic autoradiographic study.

The purpose of this study is to correlate the time of origin("birthdays") of neuroglia with myelination. The birthdays of astrocytes are spread throughout late embryonic and postnatal development while oligodendrocytes are formed only during the postnatal period. The time of origin was determined by injecting [^{3}H]-thymidine intraperitoneally into pregnant rats at 15.5 and 19.5 days of gestation and into pups at 2,5,10,14 and 17 days postnatal(d.p.n.), and then sacrificing as young adults. Heavily labeled astrocytes are occasionally present as early as 15.5 days of gestation but the peak of astrocyte production does not occur until 5 d.p.n. Oligodendrocyte formation starts at 2 d.p.n. with the maximum number of cells being formed between 10 and 14 d.p.n. In contrast to neuronal proliferation where there are often regional gradients in time of origin, the final position of heavily labeled glia in cross sections of the optic nerve appears random at the different developmental stages.

The results of the present autoradiographic study agree with previous electron microscopic observations that most oligodendrocytes are formed after astrocytes(Vaughn, '69) but these studies differ in that autoradiography indicates most oligodendrocytes are produced before 14 d.p.n. while electron microscopic cell counts indicate they are formed afterwards. This apparent discrepancy may be explained by postulating a lag of several days from the time of final cell division until morphological differentiation into young oligodendrocytes occurs. There is also a temporal lag from the earliest formation of oligodendrocytes(2-5 d.p.n.) until myelination begins at 7 days. Around 7 days oligodendrocytes send out processes to myelinate the largest diametered axons rather than adjacent small axons. This observation suggests that oligodendrocytes can "distinguish" axons of different diameters, possibly due to a trophic effect by large axons upon the oligodendrocytes. The period for oligodendrocyte production will be correlated with the interval during which myelin is formed and with biochemical markers for myelin(e.g. myelin basic protein).
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