Do Schwann cells produce collagen type III?

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Summary. The fact that collagen from both normal nerve endoneurium and Schwann cell tumours present characteristics of collagen type III, suggests that Schwann cells produce this type of collagen.

The participation of Schwann cells in the production of collagen in nerves has been a matter of controversy. Results obtained studying nerve regeneration[1] suggest that these cells produce collagen. The fact that pure Schwann cell cultures produce thin fibrils, morphologically similar to collagen, and can also incorporate proline into protein and hydroxylate this aminoacid[2,3] strongly supports the above contention.

Recently the biochemical study of human femoral nerves[4] demonstrated the presence of collagen types I and III in these structures. The distribution of these types of collagen in the peripheral nervous system has, however, not been reported so far.

To study the localization of collagen types I and III in nerves, we applied the method, developed in this laboratory, that permits the distinction of these collagen types in tissue sections by means of optical microscopy[5]. This method is based on the observation that in tissue sections, regions known to contain collagen type III, present thin pale green fibres when previously stained with Sirius Red and studied with polarization microscopy; while collagen type I – under the same conditions – presents thick fibres strongly coloured in yellow or red.

When studied by this method, all peripheral nerves obtained from 14 representative species of vertebrates (comprising fish, amphibia, reptiles, birds and mammals, including man) showed similar results characterized by the abundance of pale green thin fibres observed in the perineurium and endoneurium contrasting with the thicker yellow or red fibres of the epineurium. These results strongly suggest that collagen type I is present in the connective tissue of the nerve sheaths, while type III is mainly in the endoneurium.

The fact that the endoneurium is separated from the epi- and perineurium by the so-called perineural epithelium which constitutes not only a morphological but also a biochemical and biological barrier, allied to the observation that fibroblasts are very scarce in the endoneurium[6], lead us to believe that the Schwann cells are the most probable candidate for the site of collagen type III synthesis in nerves.

These results receive support from unpublished observations from this laboratory, showing that in tumours derived from Schwann cells (Schwannomas or neurinomas)[7], with exception of peripheral strands of collagen type I belonging to the tumour's capsule, all collagen fibres present characteristics of collagen type III.

It would be interesting to check these results with the immunofluorescent methods developed recently for the tissue localization of collagen types I and III[8], and also quantitate, biochemically, the ratio of collagen types in Schwannomas.

1 E.J. Nathaniel and D.C. Pease, J. Ultrastruct. Res. *9*, 550 (1963).
2 R.L. Church, M.L. Tanzer and S. Pfeiffer, Proc. natl Acad. Sci. USA *70*, 1943 (1973).
3 M. Bunge, J. Jeffrey and P. Wood, J. Cell Biol. *75*, 161a (1977).
4 J.M. Seyer, A.H. Kang and J.N. Whitaker, Biochim. biophys. Acta *492*, 415 (1977).
5 L.C.U. Junqueira, W. Cossermelli and R.R. Brentani, Arch. histol. jap. *41*, 267 (1978).
6 T.R. Shantha and G.H. Bourne, in: The structure and function of nervous tissue. Academic Press, New York 1968.
7 J.C. Harkin and R.J. Reed, Tumours of the peripheral nervous system. Armed Forces Institute of Pathology, Washington 1969.
8 R. Timpl, G. Wick and S. Gay, J. Immun. Meth. *18*, 165 (1977).

The influence of homologous plasma and fetal calf serum on human lymphocytic cortisol metabolism[1]

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Summary. The influence of a) tissue culture medium (RPMI), b) homologous plasma (HP), and c) fetal calf serum (FCS) on lymphocytic cortisol metabolism was compared to that of phosphate buffered saline alone. RPMI was found to enhance the conversion rate 1.71 times, whereas HP and FCS enhanced it about 3.2 times. Raising the temperature of the HP and FCS to 100 °C before incubation reduced the enhancing effect to the level of that obtained with RPMI.

The destructive effect of cortisol on lymphocytes, as well as the ability of lymphocytes to effect alterations in the molecular structure of cortisol, have been demonstrated by Dougherty and his associates[3,4]. These workers have postulated that the ability of lymphocytes to effect changes in cortisol constitutes an important homeostatic mechanism in the regulation of the lymphocyte population. Studies by Jenkins[5], who used tissue culture media, and by Klein et al.[6,7] showed that human lymphocytes are capable of metabolizing cortisol to tetrahydrocortisol (3α, 11β, 17α, 21-tetrahydroxy-5-pregnan-20-one), 20α-hydroxycortisol (11β, 17α, 20α, 21-tetrahydroxy-4-pregnene-3-one), and 20β-hydroxycortisol (11β, 17α, 20β, 21-tetrahydroxy-4-pregnene-3-one). To the best of our knowledge, no attempt has yet been made to investigate the influence of plasma on lymphocytic cortisol metabolism. In the present study, the influence of tissue culture medium (RPMI), homologous plasma (HP) and fetal calf serum (FCS) (the latter 2 both