
Dichotomizing Peripheral Afferent Fibres: A Possible Basis for Referred Pain

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Phil. Trans. R. Soc. Lond. B 1985 **308**, 413
doi: 10.1098/rstb.1985.0047

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7. Dichotomizing peripheral afferent fibres: a possible basis for referred pain

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Two mechanisms have been proposed to underlie the convergence–projection hypothesis for the referral of pain from visceral to somatic structures. Although spinal convergence would appear to explain the somato–visceral convergence reported by Cervero (this volume), there is physiological and morphological evidence to support pre-spinal convergence (Adrian *et al.* 1931; Lewis 1942). In intracellular recordings from neurons in the lumbar dorsal root ganglia (d.r.g.) of urethane anaesthetized rats, we have been able to study single d.r.g. neurons that responded to electrical stimulation of two or more branches of the sciatic nerve. There are three main findings. (1) Cooling of the different branches of the peripheral nerve showed that the convergence was due to propagated action potentials and not current spread. (2) Depolarization of the cell soma produced action potentials which were transmitted antidromically and collided with the orthodromic action potentials due to peripheral nerve stimuli. This excludes synaptic transmission as the cause of the phenomenon. (3) It appears that action potentials produced by stimulation of one nerve branch cannot necessarily be transmitted into the other branch.

In parallel with the above studies we have employed fluorescent tracers in double-labelling experiments to demonstrate the branching of peripheral afferent fibres (Taylor *et al.* 1983) in cats, rats and pigeons. These results extend those of Langford & Coggeshall (1981) and indicate the branching of peripheral afferent fibres to be a widespread phenomenon. There is therefore both physiological and morphological evidence for dichotomizing peripheral afferent fibres which could, at least in part, explain the phenomenon of referred pain.

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