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S. J. W. Lisney and M. Devor

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4. Interactions between fibres in experimental neuromata in rats

By S. J. W. Lisney† and M. Devor

Department of Neurobiology, Institute of Life Sciences, Hebrew University of Jerusalem, Jerusalem, Israel

Some nerve fibres trapped within stump neuromata show spontaneous activity and this abnormal, ectopic activity may be involved in the aetiology of painful disturbances of sensation that sometimes follow peripheral nerve injury. Here we report that indirect interactions between fibres ending in a stump neuroma can alter the patterns of this spontaneous activity.

Electrophysiological experiments were carried out on sodium pentobarbitone anaesthetized, Flaxedil paralysed, Sabra rats in which the left sciatic nerve had been cut and ligated under ether anaesthesia 4–14 days earlier. Recordings were made from fine filaments dissected from the sciatic nerve proximal to the neuroma; each filament contained one or two spontaneously active myelinated fibres. Brief trains of electrical stimuli (2, 5 or 10 s trains at 10, 20, 50 or 100 i.p.s.) were delivered to the sciatic nerve proximal to the recording site, to ipsi- and contralateral dorsal and ventral roots, and to the contralateral sciatic nerve; nerves and spinal roots were cut central to the stimulation sites.

Observations were made on 111 spontaneously active myelinated fibres from 17 rats. Repetitive stimulation of the nerve proximal to the neuroma produced an increase in impulse discharge rate in about two thirds of the fibres. This response lasted from a few seconds to up to 3 min, depending upon the fibre. The usual test stimulus was a 10 s train of stimuli at 100 i.p.s., but shorter periods of stimulation and lower stimulation rates were also effective in changing the activity of neuroma fibres, usually to a lesser extent. In addition, some previously silent fibres were provoked into activity by these trains of stimuli. There was no evidence that these responses were due to ephaptic crosstalk between fibres in the neuroma. Similar responses were observed following stimulation of the ipsilateral L3–6 dorsal and/or ventral roots, spinal roots that contribute fibres to the sciatic nerve, but not following stimulation of the ipsilateral L1 and 2 dorsal and ventral roots. Stimulation of the contralateral L3–6 dorsal and ventral roots or of the contralateral sciatic nerve also failed to alter the activity of spontaneously firing neuroma fibres. Intravenous infusion of phentolamine (10 or 20 μg), an α-adrenergic antagonist, did not alter the responses to ipsilateral sciatic nerve or L3–6 spinal root stimulation.

† Present address: Department of Physiology (Oral Biology), The Medical School, University Walk, Bristol BS8 1TD, U.K.