

nature of the competitive interaction, the morphological distribution of axons from the two nerves, the inter-relationships of their terminals with each other and with old endplate structures, the mechanism(s) whereby one loses influence when a second nerve grows into the muscle, and the degree to which an original (appropriate) nerve is favoured in the competition.

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## Is there retrograde axonal transport of tetanus toxin in both $\alpha$ and $\gamma$ fibres?

It has been demonstrated by means of histoautoradiography that tetanus toxin, after injection into a muscle, reaches motoneurons in the spinal cord by retrograde axonal transport<sup>1–3</sup>. It was until now not known whether the labelled motor axons and motoneurons belong to the  $\alpha$ , the  $\gamma$ , or to both  $\alpha$  and  $\gamma$  populations. We now present evidence that tetanus toxin is selectively transported in  $\alpha$  motor neurons.

In two cats, <sup>125</sup>I-labelled tetanus toxin was injected into one gastrocnemius muscle (4 and 5  $\mu$ g toxin per kg body weight respectively; the toxin was labelled according to the method of Habermann<sup>4,5</sup>, and contained 2  $\mu$ Ci and 4,500 mouse MLD. One cat MLD was equal to 5.4  $\mu$ g toxin/kg body weight). Three days later the cats were anaesthetised with Nembutal, a laminectomy was performed and the ventral roots L7 and S1 were ligated on the toxin side. The cats survived for another 8½ and 3¼ hours respectively, during which time they were given intensive care<sup>6</sup>. The ligated roots were then excised and immersed in Karnovsky's fixative. Paraffin sections (8  $\mu$ m) were cut proximal and distal to the ligature and submitted to histoautoradiography using Ilford G5 emulsion. The autoradiographs were developed with Kodak D 19b developer after 71 d and 81 d of exposure at 4 °C. Outer myelin sheath circumferences were measured at a magnification of 800 with a Kontron Manual Optic Point Counting Device (MOP/AM 01). Fibre size histograms were constructed for a representative sample of all fibres (labelled and unlabelled), and for all the labelled fibres, in each of three ventral roots. An example is given in Fig. 1. Two populations of fibres were found, with peaks at around 5  $\mu$ m and 14  $\mu$ m diameter. These values are very similar

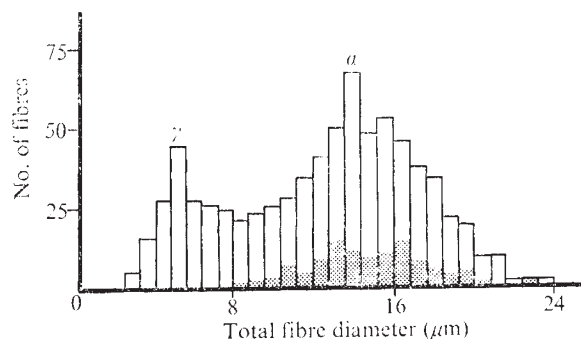


Fig. 1 Fibre size histogram from one fascicle of the ventral root L7 in a cat after injection of <sup>125</sup>I-labelled tetanus toxin into the ipsilateral gastrocnemius muscle. Open = labelled and unlabelled fibres ( $n=742$ ), stippled = labelled fibres ( $n=106$ ).  $n$  = Number of fibres measured. Total number of fibres in fascicle, ~1,500. Total number of labelled fibres, 106.

to those described previously for the  $\gamma$  and  $\alpha$  populations of cat gastrocnemius motor fibres<sup>7</sup>.

The accumulation of radioactivity at the ligature would be expected to reveal the presence even of very small amounts of intra-axonal label. Even in these conditions, radioactivity in the ventral roots was found only in fibres which, from their size, seem to belong to the  $\alpha$  population<sup>7</sup>.

This result is an interesting contrast to the findings of Strick *et al.*<sup>8</sup> who injected horseradish peroxidase into cat gastrocnemius muscle and found  $\gamma$ -motoneurons even more intensely labelled than  $\alpha$ -motoneurons. Further studies are needed into the mechanism responsible for the apparent lack of tetanus toxin in the  $\gamma$  axons. A barrier function of structural elements of the muscle spindle or a specific feature of the  $\gamma$ -fibre terminal must be taken into consideration.

Moreover, the increase of  $\gamma$  bias in local tetanus described by Takano *et al.*<sup>9,10</sup> cannot be explained by assuming that tetanus toxin accumulates in  $\gamma$  motoneurons by intra-axonal ascent in  $\gamma$ -motor fibres.

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