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FIBRE CALIBRE SPECTRA OF NERVES TO THE MASTICATORY MUSCLES IN THE CAT

by

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INTRODUCTION

The masseter, the temporal and the medial pterygoid muscles of different species are known to be richly endowed with spindles (*Freimann*, 1954, man; *Cooper*, 1960, cat and goat; *Karlsen*, 1965, rat). The same authors deny the presence of spindles in the lateral pterygoid muscle of the respective species. Recently, however, *Honée* (1966) recorded a few spindles, from one to fifteen, in the lateral pterygoid muscle of man and *Christensen* (1967) found a few spindles in some of the examined specimens of the miniature swine where he examined restricted areas of the lateral pterygoid muscle near to its insertion into the disk. On this background a reexamination of the possible presence of spindles in the lateral pterygoid muscles of the cat was found worthwhile. Also, since spindle afferents are of known diameter and reflected in the pattern of the calibre spectrum (*Hunt*, 1954; *Murphy & Cameron*, 1967), calibre-spectra of the masseter, the temporal, the medial and lateral pterygoid nerves were prepared.

MATERIAL AND METHODS

Three adult cats were used. The animals were anaesthetized with Nembutal, and the nerves to the masseter, the temporal, the medial and lateral pterygoid

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muscles of one side were dissected free under a dissecting microscope. The specimens of the nerves were taken close to the muscle. Fixation was made in 10 % formole. The further procedure, including staining with Sudan-black B, was in accordance with the methods used by *Korneliussen* (1964). Sections ranging from 5 to 10 microns in thickness were microphotographed at a magnification of 470. The fibre diameters were measured on the photographs while comparing with the section under the microscope. Correction was made for the shrinkage which is 16 % (*Korneliussen*, 1964). The fibres were divided into 1 micron-groups as appearing in the histograms. Since errors may be involved when sampling only a restricted area of the nerve (*Donovan*, 1967), a total count of the myelinated fibres was made.

Three lateral pterygoid muscles corresponding to the examined nerves were examined for spindles. Since spindles have been recorded in the insertion area on the disk (*Christensen*, 1967) the muscles were removed with parts of their bony attachments, fixed in 10 % formole, decalcified, sectioned transversely 10—15 microns thick and stained with van Gieson's stain. Every fifth section was mounted and examined by two investigators.

OBSERVATIONS

Transverse sections of the masseter and lateral pterygoid nerves are shown in Fig. 1 a, b. The calibre spectra are presented in the histograms of the four nerves (Fig. 2—5). These histograms represent the mean of the findings in the three specimens. Despite minor discrepancies the distribution pattern

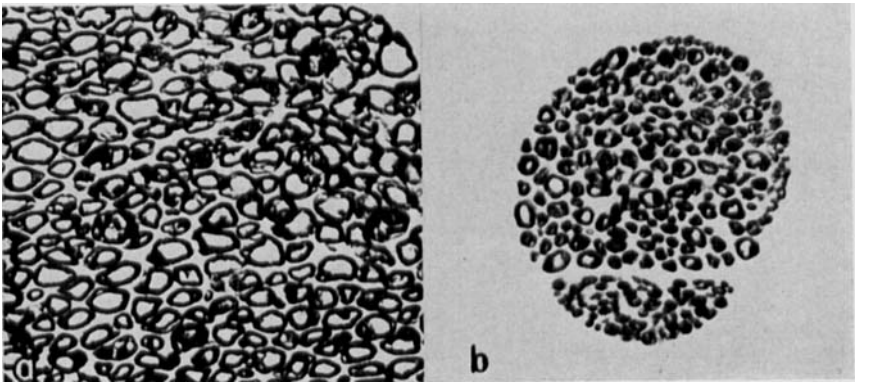

Fig. 1 a, b. Transverse sections of
a) a limited area of the masseter nerve
b) the lateral pterygoid nerve. Magnification × 313.

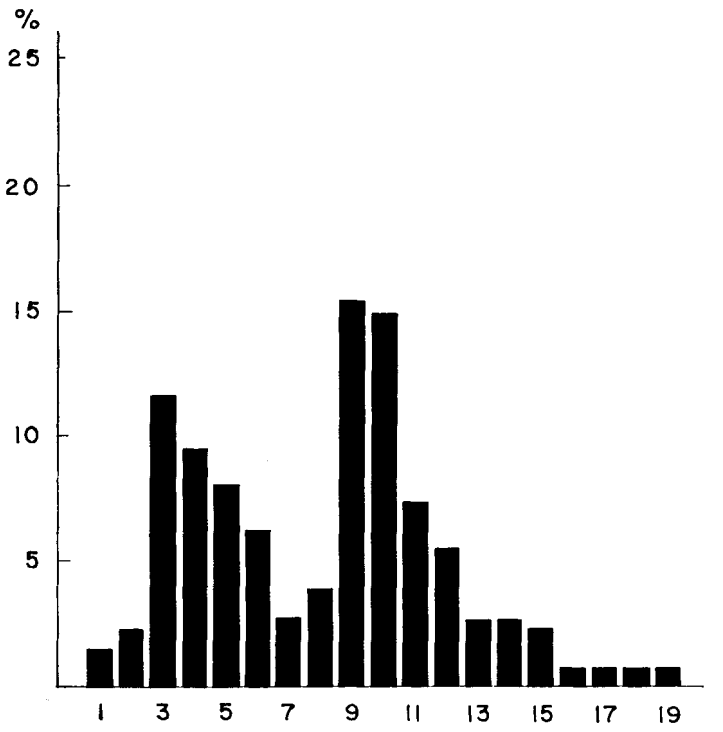

Fig. 2. Histogram of the calibre spectrum of the masseter nerve.

in each of the nerves was the same in the three specimens. Thus a conspicuous bimodal distribution is apparent in the masseter, the temporal and the medial pterygoid nerves with a great-fibre peak at 8—11 microns and a small-fibre peak around 3 microns. Few fibres exceeded 14 microns. The fibre spectrum of the lateral pterygoid nerve, on the other hand, has only a slight bimodality with a greater peak at 7—8 microns and a smaller at 2—3 microns. However, in all the three specimens the bimodality of this nerve was very little pronounced. Fibres exceeding 14 microns were not found.

The mean number of myelinated fibres observed in the four nerves in the three specimens were: the masseter nerve 1015, the temporal nerve 1125, the medial pterygoid nerve 715 and the lateral pterygoid nerve 281. These

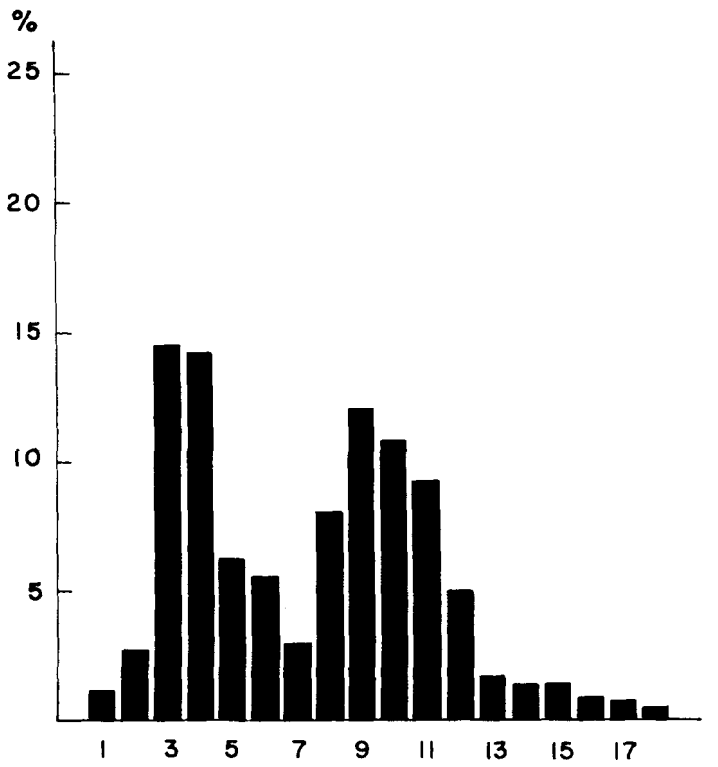

Fig. 3. Histogram of the calibre spectrum of the temporal nerve.

figures are the mean of the three specimens. The difference from this mean was less than 20 % in all the nerves.

No spindles were found in the three lateral pterygoid muscles where also parts of the attachment areas were sectioned and examined.

DISCUSSION

The thickest afferent fibres from skeletal muscles (group I afferents) all originate in primary endings of muscle spindles and tendon organs. The largest group I afferents from a given muscle are usually slightly thicker than the alpha efferents of the same muscle (*Rexed & Therman*, 1948). The striking finding of the present investigation was the absence of nerve fibres above 14 microns in the lateral pterygoid nerve and the less pro-

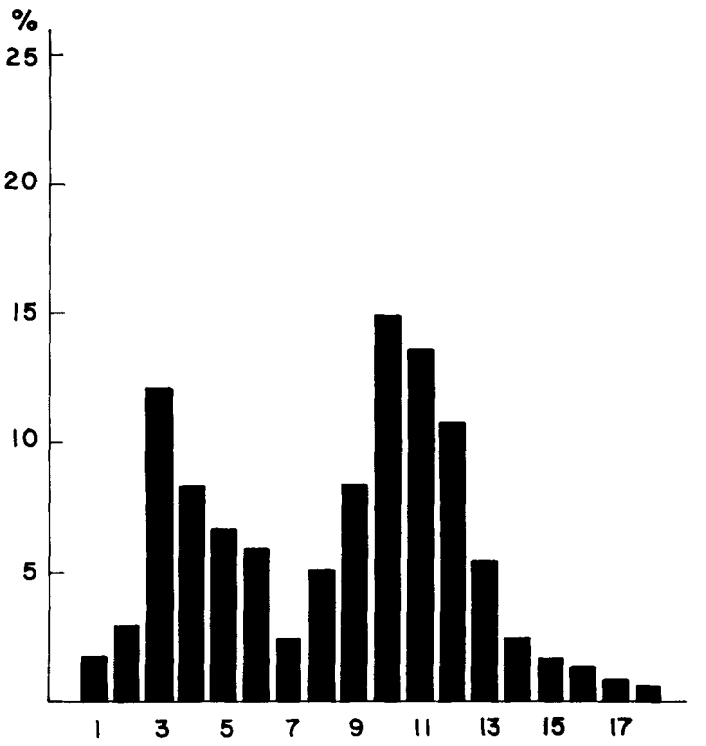

Fig. 4. Histogram of the calibre spectrum of the medial pterygoid nerve.

nounced bimodality of fibre diameters in this nerve compared to the definite bimodality and presence of thicker fibres in the masseter, the medial pterygoid and the temporal nerves. The simplest explanation for the finding is that the lateral pterygoid muscle of cat, as concluded by *Cooper* (1960), contains no muscle spindles as indeed was indicated by the histological examination of the muscle. A similar conclusion was reached by *Thilander* (1964) from studies in man. Quite possibly tendon organs are also lacking in this muscle.

On the other hand, the presence of large fibres in the masseter, the medial pterygoid and the temporal nerves, the muscles of which are known to contain a fair number of muscle spindles (*Cooper*, 1960) suggests that the spindle afferents of these muscles belong to the thickest fibres of the muscle nerve as is the case for the limb muscles.

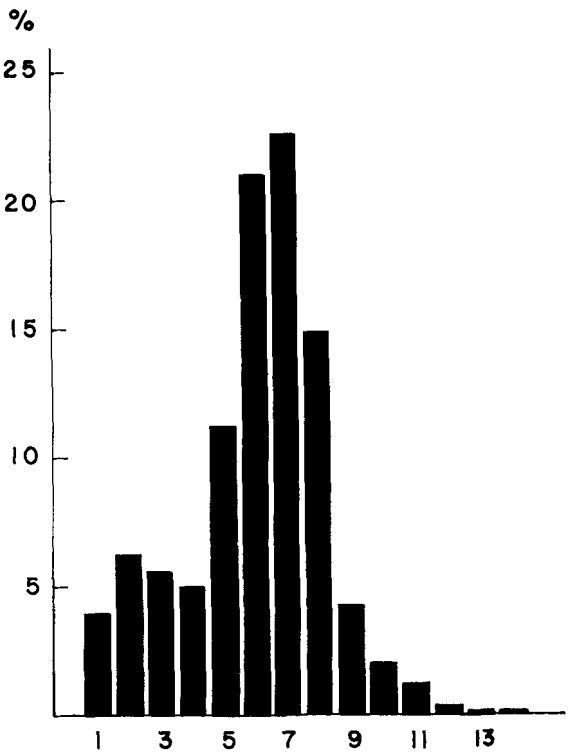

Fig. 5. Histogram of the calibre spectrum of the lateral pterygoid nerve.

Elsewhere in this study the species differences as regards the presence of spindles in the lateral pterygoid muscle are mentioned. This variation might seem strange. However, since *Honée* (1966) finds from fifteen to only one spindle in man, and *Christensen* (1967) a few or none in the miniature swine, this might even indicate a possibility of spindle-containing as well as spindle-free lateral pterygoid muscles within the same species.

SUMMARY

Three cats were used for studies of the calibre spectra of the nerves to the masticatory muscles.

The masseter, temporal and medial pterygoid nerves were clearly bimodal with peaks at 8—11 and at 3 microns. Few fibres exceeded 14 microns.

The lateral pterygoid nerve had peaks at 7—8 and 3 microns but the bimodality was little pronounced since the small-fibre peak was almost suppressed. No fibres exceeded 14 microns.

The three corresponding lateral pterygoid muscles were examined for spindles but none were observed.

RÉSUMÉ

DISTRIBUTION DU CALIBRE DES FIBRES DANS LES NERFS DES MUSCLES MASTICATEURS CHEZ LE CHAT

La distribution du calibre dans les nerfs des muscles masticateurs a été étudiée chez 3 chats.

La distribution dans les nerfs du masséter, du temporal et du ptérygoïdien interne était nettement bimodale, avec des sommets à 8—11 microns et à 3 microns. Peu de fibres dépassaient 14 microns.

La distribution dans le nerf du ptérygoïdien externe avait deux sommets, l'un à 7—8 microns et l'autre à 3 microns, mais la bimodalité était très peu prononcée, car le sommet des petites fibres était presque supprimé. Aucune fibre ne dépassait 14 microns.

Aucun fuseau n'a pu être observé dans les trois muscles du ptérygoïdien externe correspondant qui ont été examinés à ce sujet.

ZUFAMMENFASSUNG

KALIBERSPEKTRA DER KAUMUSKELNERVEN IN DER KATZE

Drei Katzen würden für eine Untersuchung des Kaliberspektrums der Kaumuskelnerven benutzt.

Die Nerven masseter, temporalis und pterygoideus medialis waren ausgeprägt bimodal mit Gipfeln bei 8—11 und 3 Microns. Wenige Nervenfasern waren über 14 Microns.

Der Nervus pterygoideus lateralis hatte Gipfel bei 7—8 und 3 Microns, aber die Bimodalität war sehr swach da der Kleinfasern-Gipfel beinahe underdrückt war. Fasern über 14 Microns wurden nicht gefunden.

Die drei entsprechenden lateralen Pterygoidmuskeln wurden im Hinblick auf Spindeln untersucht, aber keine wurden gefunden.

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