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Anatomical Note

The presence of oxytalan fibres in normal and regenerating rat leptomeninx: an ultrastructural demonstration

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INTRODUCTION

Oxytalan fibres, a special type of fibre in connective tissue (Fullmer & Lillie, 1958), have been included in a group of interrelated fibres, namely elastic, elaunin and oxytalan (Cotta-Pereira, Guerra Rodrigo & David Ferreira, 1978). As stated by Fullmer (1960), oxytalan fibres meet the following criteria: (*a*) they do not stain with routine techniques available for elastic fibres; (*b*) they do stain with such techniques after pre-oxidation with peracetic acid; (*c*) they are found in normal adult tissues.

Ultrastructural studies reveal that oxytalan fibres consist of bundles made up to fibrils 10–15 nm in diameter. Characteristically, they lack transverse periodic banding, making them similar to the peripheral microfibrillar component of elastic fibres (Carmichael & Fullmer, 1966; Sheetz, Fullmer & Narkates, 1973; Cotta-Pereira *et al.* 1976, 1978; Soames & Davies, 1978; Alexander, Clayton, Howes & Garner, 1981; Goldfischer, Coltoff-Schiller, Schwartz & Blumenfeld, 1983).

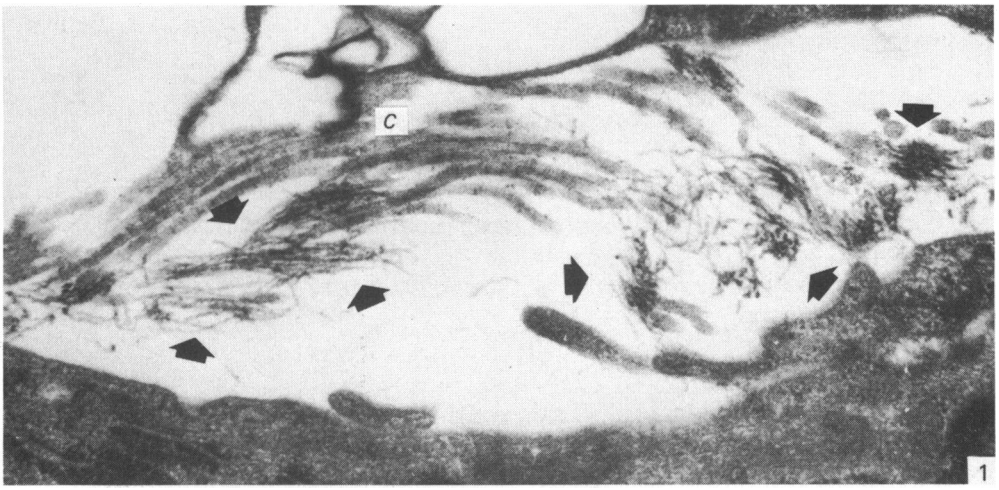
Oxytalan fibres have been found in the periodontal ligament (Sims, 1975; Soames & Davies, 1978), dermis (Cotta-Pereira *et al.* 1976), cornea (Alexander *et al.* 1981), pineal gland (Calvo & Boya, 1983) and aortic adventitia (Takagi, Parmley, Yagasaki & Toda, 1984). However, their presence in the leptomeninx has not previously been established.

MATERIAL AND METHODS

Six Wistar albino rats of both sexes aged 5 months were used as controls. Three more animals of the same age were set apart and, under ether anaesthesia, subjected to an aseptic cerebral stab wound operation. Using a heated stylus, a vertical puncture 3 mm in depth was made into the brain 3 mm behind the frontoparietal suture. Observations were made 30 days, 2 and 3 months after operation. Animals were deeply anaesthetised with ether, the brains removed and prepared for electron microscopy.

The stalks of pineal glands were collected from the control group, to study the leptomeningeal thickening that normally exists. In the experimental group, samples were collected from the wall of the stab wound canal, where new leptomeninx was regenerating.

All tissue samples were fixed by immersion in phosphate buffered 3 % glutaraldehyde, postfixed in phosphate buffered 1 % osmium tetroxide and embedded in Vestopal or Epon. Ultrathin sections were cut on a LKB ultramicrotome. They were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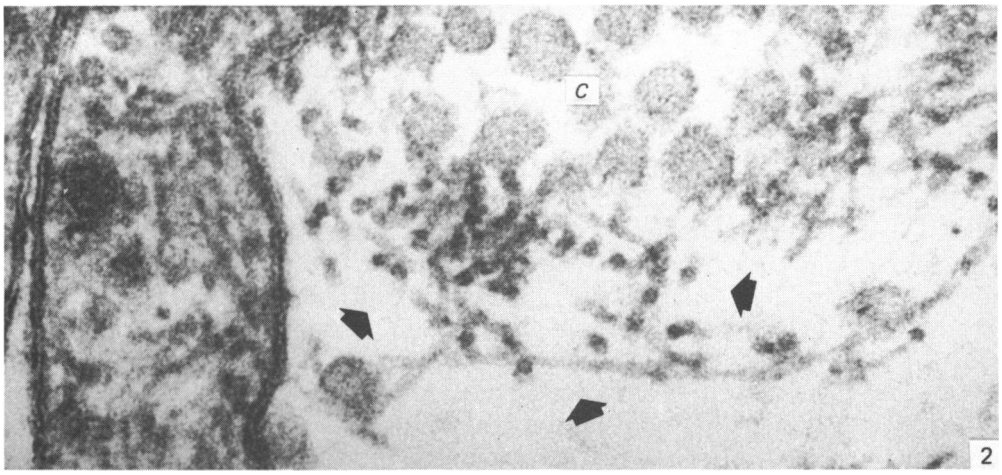
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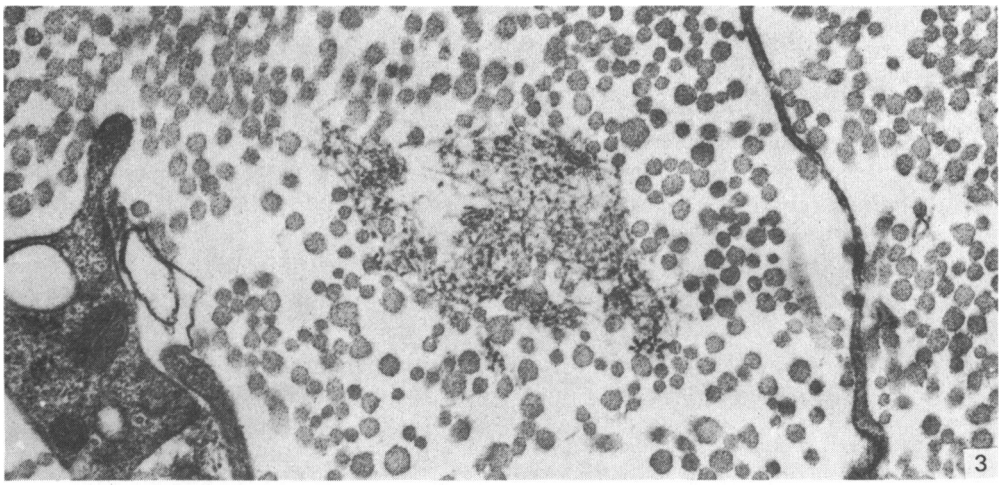
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double stained with uranyl acetate and lead citrate and examined in a Philips EM201 electron microscope.

RESULTS AND DISCUSSION

In both normal and regenerating leptomeninx, sparse, slightly undulating fibrils 10–15 nm thick appeared in the subarachnoid space between normal and regenerating cellular meningeal elements. They had a homogeneous appearance and transverse banding was absent (Fig. 1). At high magnifications, transverse sections displayed an apparently empty central space in the fibrils (Fig. 2). Occasionally isolated fibrils were seen scattered between collagen microfibrils. Most frequently they were arranged in small bundles in parallel with collagen microfibrils but were sometimes locally disordered. Accumulations of such fibrils were seen interspersed with masses of collagen microfibrils in the fibrous areas of regenerating leptomeninx (Fig. 3). Furthermore, these collagen microfibrils showed distinct differences in transverse diameter. Though intentionally sought, there was not any constant relationship of the fibrils described either with other components of the subarachnoid space or with basement membranes.

This study clearly demonstrates the presence of oxytalan fibres in normal and regenerating adult rat leptomeninx. We do not consider them to be microfibrils of pre-elastic material because elastic fibres could never be found in the sections studied. Ultrastructural appearances are largely comparable to former descriptions of oxytalan fibres (Carmichael & Fullmer, 1966; Cotta-Pereira *et al.* 1976, 1978; Soames & Davies, 1978; Calvo & Boya, 1983); their tubular structure has also been described previously ('fibrotubules' of Cotta-Pereira *et al.* 1976; Calvo & Boya, 1983).

Oda & Nakanishi (1984), studying the ultrastructure of mouse leptomeninx, recognise bundles of tubular 10 nm thick fibrils which closely resemble those in the present investigation but they do not identify them as oxytalan fibrils.

SUMMARY

The present ultrastructural study demonstrates the presence of oxytalan fibres in normal and regenerating leptomeninges of adult albino rats. They appear as bundles of fibrils 10–15 nm thick without transverse striations, which frequently merge with collagen microfibrils.

Fig. 1. Adult rat leptomeninx. Subarachnoid space showing thin fibrils (arrowheads) forming small bundles interspersed among the collagen microfibrils (*C*). × 38400.

Fig. 2. Transverse section of oxytalan fibres (arrowheads). Note a lesser central density. *C*, collagen microfibrils. × 168000.

Fig. 3. Fibrous area in regenerating leptomeninx. Small bundle of oxytalan fibres between abundant collagen microfibrils. × 40320.

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