Morphological Correlate to a Cholinergic Sympathetic Function

THE sympathetic ganglion cells in the cat are heterogeneous with respect to acetylcholinesterase (AcChE) activity when stained histochemically with the thiocholine method^{1,2}. Only a limited number possess high AcChE activity (heavy staining) comparable with that of anterior horn cells and other accepted cholinergic cells. The majority of the sympathetic ganglion cells show very faint or no activity. Some cells are intermediate with respect to staining intensity. There has been recent discussion whether the outstandingly 'AcChE-rich' cells are correlated to a peripheral cholinergic function¹⁻³; but definite proof for such a hypothesis has been lacking until now. In an earlier paper² it was shown that the stellate ganglion is especially rich in cells with high AcChE-activity compared with the superior cervical ganglion and the prevertebral ganglia. This communication explains that finding.

It is known that sectioning of the post-synaptic fibres of nerve cells results in their becoming tigrolytic, that is, loss of ribonucleic acid (RNA)-staining, and it also results in a reduction of their AcChE-activity⁴. The staining methods for RNA and AcChE⁵ were used to associate the AcChE-rich nerve cells in the stellate ganglion with their appropriate post-ganglionic outflow. It was found that sectioning of the cardiac nerves had no influence on the AcChE-rich cells while the opposite type of operation (sectioning of all post-ganglionic fibres except the cardiac nerves) resulted in an almost complete disappearance of AcChE from the majority of these cells. Denervation experiments performed in different combinations showed that practically all AcChE-rich nerve cells in the stellate ganglion give rise to post-ganglionic fibres to the fore leg. The changes in the AcChE-rich ganglion cells could be correlated to different degrees of cholinesterase disappearance from the sweat glands of the fore paw. It was now logical to study histochemically the ganglia which innervate the hind leg. When the ganglia of the sympathetic chain were examined AcChE-rich cells were found in significant amounts in the region of L6-S2. The well-defined cell-type described is very unusual in other paravertebral ganglia (Fig. 1) and seems to be almost lacking in the prevertebral ganglia. A typical

Fig. 2. Frequency diagram showing the number of AcChE-rich ganglion cells in different lumbosacral ganglia after 30 min. incubation

frequency diagram for lumbosacral ganglia is shown in Fig. 2.

The above-mentioned experiments will be described and discussed in detail in a series of later papers.

It should be pointed out here that the AcChE-rich sympathetic ganglion cells are predominantly localized in those particular ganglia which give rise to post-ganglionic fibres to the cholinergic sweat glands⁶, the classical exception in the sympathetic nervous system with respect to neurohumoral transmission⁷. There is a striking similarity between Langley's classical experiments and the findings presented here.

It is evident that the AcChE-rich cells described constitute the morphological correlate to a pharmacologically well-known cholinergic function within the sympathetic nervous system of the cat.

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⁴ Schwarzscher, H. G., *Acta Anat.*, **32**, 51 (1958).

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⁶ Langley, J. N., *J. Physiol.*, **12**, 347 (1891).

⁷ Dale, H. H., and Feldberg, W., *J. Physiol.*, **82**, 121 (1934).

Fig. 1. Photomicrographs from representative fields of four sympathetic ganglia stained for AcChE. Thiocholine method. Incubation time, 30 min. Light microscope. ($\times$ c. 77)

Physiological Disposition and Fate of Nicotine labelled with Carbon-14 in Mice

COMPARATIVELY few investigations have been reported concerning the tissue distribution of nicotine. These previous studies, which were performed using chemical¹⁻⁴ and radiometric⁵ methods, showed wide discrepancies. In order to try to elucidate the reason for these diverging results and to obtain further information regarding the pharmacological actions of nicotine we have performed whole-body autoradiography using labelled nicotine. Carbon-14 was introduced in the methyl group by methylating nornicotine with formaldehyde-¹⁴C (ref. 6).

White mice weighing about 20 gm. were injected intramuscularly with nicotine labelled with carbon-14. The dosage used was 10 μ gm./gm. body-weight corresponding to a radioactive dose of approximately 0.1 μ c./gm. body-weight. In a few experiments pregnant mice were used to allow a study of the placental passage of nicotine. The mice were killed 1, 2, 5, 7, 10,