Thus the conclusion can be reached that the spindles of the eye muscles have their perikaria in the semilunar ganglion, as has been pointed out in our previous papers[1–3]. However, this is not the case for the spindles of the masseter whose perikaria are located in the brain stem.

Riassunto. Lo stiramento di singoli muscoli estrinseci dell'occhio determina nel ganglio semilunare dell'agnello risposte del tipo di quelle indotte dai fusi neuromuscolari anche dopo sezione cronica del tratto pontogasseriano ipsilaterale. Ció prova che i pirenofori delle fibre afferenti dai fusi dei muscoli estrinseci dell'occhio sono realmente contenuti nel ganglio semilunare di Gasser.

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The Neural Lobe of the Neurohypophysis of the Rat: Several Types of Nerve Endings

Since the electron microscope was applied to the study of the structure of the neurohypophysis, it has become clear that most of the nerve fibres forming the infundibular process are neurosecretory axons originated in the supraoptic and paraventricular nuclei. However, the existence of non-neurosecretory axons of other origin has also been reported by many authors on the ground of light microscopy evidence. Review by Christ[1].

The ultrastructure of the neurohypophysis of Wistar rats of both sexes was studied. Rats were decapitated and the neurohypophysis fixed in glutaraldehyde 6.5% overnight and postfixed in osmium tetroxide 2% for 2 h. Both fixatives were buffered at pH 7.4 in Millonig buffer. The glands were embedded in Epon 812 as usual and stained with 1% aqueous uranyl-acetate and then lead citrate following Reynolds[2].

It was seen that most of the nerve fibres and nerve endings belong to the neurosecretory type. The elementary neurosecretory granules range from 1000 to 3000 Å, as had been described previously[3]. In the nerve endings of this type, besides the neurosecretory granules, there are numerous clear vesicles similar to the synaptic vesicles. The diameter of these vesicles is from 200 to 700 Å and they may be seen scattered through all the endings or grouped in clusters (Figure 1,a).

A second type of nerve endings is much less frequent than the first type and its main feature is given by the presence of synaptic vesicles and the complete absence of neurosecretory granules or dense core vesicles (Figure 1,b). This type of axon bulbs has already been described by Kobayashi[4].

A third type is represented by nerve endings in which synaptic vesicles as well as dense core vesicles are found intermingled. The number of the dense core vesicles varies, and their size ranges between 650 and 1400 Å with a mean of 1000 Å (Figure 1,c).

A fourth type of nerve endings contains synaptic vesicles, some round granules of 800 Å diameter, ranging from 600 and 1000 Å and others with oval shape of 1500×900 Å diameter, having a limiting membrane and either a central or an eccentric dense core separated from the membrane by a wide clear space. When the central core is eccentric it is also smaller, and in these cases the electronic density of the granules is higher (Figure 1,d).

It can be concluded from these results that in the neural lobe of the rat there exist several types of nerve endings (Figure 2) which very probably belong to different systems. The more numerous nerve fibres belong to the classic neurosecretory systems. 2 elements have been recognized in the nerve endings of this system: the elementary neurosecretory granules containing oxytocin and/or vasopressin[5] and the clear vesicles known as synaptic vesicles. In the leech 3 kinds of elementary neurosecretory granules varying in size and electron density have been recognized[6]. Our grouping of all the neurosecretory nerve endings in the first type does not mean that in the rat there is only one type of neurosecretory axons; on the contrary, more than one kind can be recognized (unpublished observation).

As regards the second type, that is nerve endings containing pure synaptic vesicles, the first question that might be raised is if they are a definite type or they only represent tangential sections of other types of endings. Although the question cannot be answered conclusively without the study of serial sections, some pictures are very suggestive in the sense that they are a definite type. The characteristics of this type correspond to those of cholinergic terminals.

The third type of nerve endings have the ultrastructure characteristics of those terminals that end around the primary capillaries of the portal system[7]. It has yet to be cleared up whether the terminals of the third type represent an extension to the neural lobe of the endings described by Monroe[7] in the median eminence, or if they belong to another neurosecretory system.

The ultrastructure characteristics of the fourth type correspond to those of adrenergic nerves. Using fluorescent histochemical techniques Björklund[8] has recently described a rich system of monoamine containing fibres in the neural lobe of the rat. Only a few of these fibres disappeared when the rats were sympatectomized. Our fourth type may represent these fibres because, besides having the structural characteristics of monoamineragic fibres they are also very scarce and difficult to find. The remaining ones, those that do not disappear following sympatectomy and that constitute most of the fluorescent fibres found in the neurohypophysis may be our third type. This speculation is consistent with the assumption that our third type could contain a monoamine. However, as Monroe[7] stated for the axons ending around the portal capillaries, it appears much too early to accept as a proven fact that these dense core vesicles are carriers of cathecholamines.

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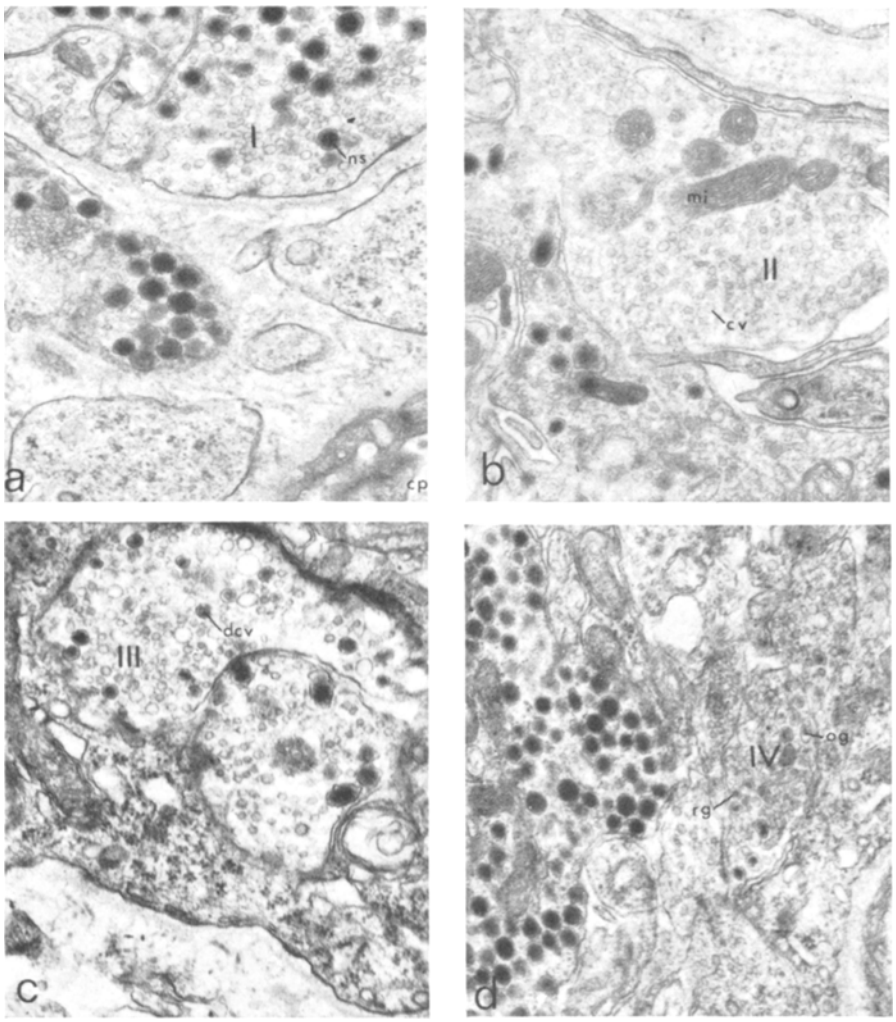

Fig. 1. Nerve endings of the neural lobe: (a) type I; (b) type II; (c) type III; (d) type IV. × 22,000. cp, capillary; ns, neurosecretory granules; cv, clear vesicles; mi, mitochondria; dcv, dense core vesicles; rg, round granules; og, oval granules.

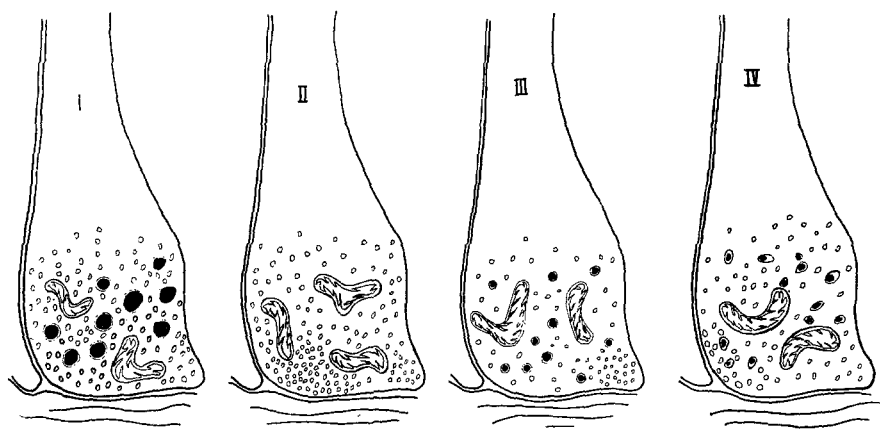

Fig. 2. Diagram of the several types of nerve endings in the neural lobe of the neurohypophysis of the rat.

It has been claimed that both cholinergic and adrenergic mechanisms could be involved in the release of oxytocin and of antidiuretic hormones from the neural lobe. These several types of nerve fibres in the neurohypophysis may constitute the anatomical substract for these mechanism.

Resumen. Se ha estudiado la zona pericapilar del proceso infundibular de la neurohipofisis de ratas de ambos sexos. El análisis del material al microscopio electrónico reveló cuatro tipos de terminales nerviosas. Tipo I: con gránulos que pertenecen al sistema peptidérgico; Tipo II: con las características de las terminales colinérgicas; Tipo III: similares a las terminales de la eminencia media; Tipo IV: de igual ultraestructura que las terminales de los nervios adrenérgicos.

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