CERTAIN CELLS IN THE HYPOTHALAMIC NEUROSECRETORY NUCLEI WHICH ARE STAINABLE BY THE ACID-HAEMATEIN TEST FOR PHOSPHOLIPIDS ACCORDING TO BAKER

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With 15 Figures in the Text

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A. Introduction

In the supraoptic nucleus and the paraventricular nucleus, two types of cells can be distinguished. The more numerous of these are large ganglion cells with round vesicular nuclei and large nucleoli, and Nissl substance localized at the periphery of the cell. In addition there are longer more fusiform cells with more compact structure. In sections stained with aldehyde-fuchsin or with chrome alum-haematoxylin-phloxin, these cells in their entirety show a more uniform and darker colour than the other cells. Like the larger and lighter cells, these cells sometimes contain intensely staining granules disseminated through the cell body. The nucleus of these cells is often small, and sometimes of pyknotic structure, in which case it is difficult to distinguish the nucleolus. A study of the region of the neurosecretory nuclei in serial sections from rats (the two types of ganglion cells have also been described in mouse, guinea-pig, rabbit, dog and man) shows that the fusiform cells of the supraoptic nucleus often occur along the optic tract and around the blood vessels which extend inward from the pia past the nucleus. Always, however, they are situated among the light, round ganglion cells and occasionally they can be found outside the nucleus. In the paraventricular nucleus the number of fusiform cells in serial sections increases in a distal direction in the lateral apices of these triangular nuclear areas. In these sections also the fibres are encountered which emerge from the paraventricular nucleus. The number of compact fusiform cells is as a rule larger in the supraoptic nucleus (s.o.n.) than the paraventricular nucleus (p.v.n.). It is often difficult to decide whether transitional forms between the two types of cells occur.

Various investigators have studied — although with poor agreement — the compact fusiform cells, and particularly those in the s.o.n. On the basis of their descriptions or illustrations it is fairly certain that always the same elements are meant.

ORTMANN (1951) described, in normal rats, dark-staining ganglion cells loaded with many drops of neurosecretion, which he regarded as resting “storage cells”, in addition to round ganglion cells containing only a small quantity of neurosecretion. After administration of NaCl he observed cells in the s.o.n., the perikaryon and nucleus of which had a compact and pyknotic appearance and showed homogeneous acidophilic staining. This condition sometimes amounted to complete degeneration of the cells.
BACHRACH (1957), during the phase of restitution in thirsting rats, observed, in addition to the large hypertrophic ganglion cells of low Gomori-positivity which he calls type a, an increase of another type: small, highly Gomori-positive fusiform cells entirely filled with secretion, which he calls type b. Because after 8 days' thirsting only type b is seen, these cells must originate from those of type a. BACHRACH believes they are secretion-forming rather than secretion-storing cells.

BARGMANN (1948/49, 1954) has pointed out that in the neurosecretory ganglion cells a secretory cycle is found which corresponds to the cyclic formation of secretion in glandular cells in general. In his opinion the cells showing homogeneous hyperchromatic staining should be regarded as a terminal point or maximum in the secretory cycle of these cells.

In rats after thirsting or salt administration, we have observed an increase in the number of fusiform cells staining homogeneously with aldehyde-fuchsia or chrome alum-haematoxylin-phloxin, particularly in the s.o.n. (in this nucleus at any rate it was much more distinct than in the p.v.n.). This difference in reaction between the s.o.n. and p.v.n. in "stressing" of the water metabolism has also been pointed out by other investigators [cf. DUFEN (1962), p. 235].

MILLIN (1960) found analogous cellular changes in the s.o.n. — an increase in "cellules sombres" — in rabbits, hares and rats subjected to stress by various emotional stimuli (sonic vibrations, immobilization). In his opinion it is not impossible that these phloxinophil cells might have a biological significance different from that of the neurosecretory cells.

HAGEN (1952, 1955, 1957), who studied extensively the histology of the neurosecretory nuclei under normal and experimental conditions, repeatedly describes hyperchromatic fusiform ganglion cells in these nuclei, besides rounder and lighter cells. In her publications on the neurosecretory nuclei in dogs after pancreatectomy (1955) and after lesions of the infundibulum (1957), there are many illustrations depicting hyperchromatic fusiform cells with pyknotic nuclei. Because these elements may finally shrink, her conclusion is that this should be regarded as "physiological degeneration" in the sense of a holocrine secretion — a process which she assumes also to play a role in the formation of the Herring bodies. HAGEN also regards this as a process of significance in normal formation of neurosecretion. In view of the homogeneous red coloration of these cells in specimens stained with chrome alum-haematoxylin-phloxin, she uses the designation "red degeneration". Her co-workers BERGER (1962) and VIERMANN (1962), studying asthmatic guinea-pigs and castrate dogs respectively, also described and depicted many fusiform ganglion cells with dense protoplasm and pyknotic nuclei in the s.o.n. and the p.v.n. These again occurred among large ganglion cells having round nuclei and large nucleoli, and containing Nissl substance in the periphery.

WALCZAK and KOZIK (1958), studying guinea-pigs which had been scorbutic for 21 days or longer, found in the s.o.n. an increase of compact cells showing homogeneous staining of the entire cell. In the accompanying illustrations we see these fusiform, dark cells (Gomori staining) among light, round ganglion cells.