

Some Evidence on the Functional Ultrastructure of the Nucleolus-like Bodies or Nematosomes in the Cytoplasm

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Nucleolus-like bodies (NLBs) or nematosomes were described in the cytoplasm of rats' hypothalamic neuroendocrine cells (from Nucleus arcuatus and subfornical organ) as well as in the ovarian granulosa cells. The presence of large nucleolus-like bodies in stimulated cells has been discussed in connection with increased nuclear/cytoplasmic RNA export from the nucleus to the cytoplasm.

Key words: nematosomes, ultrastructure, nucleo-cytoplasmic transport.

Introduction

H o l m g r e n [5] first has described the nucleolus-like bodies (NLBs) in the cytoplasm of spinal ganglion neurons of rabbit and frog. T e w a r i and B o u r n e [13] histochemically have suggested that these NLBs represented nucleoli extruded into the neuronal cytoplasm. Later the fine structure of NLBs have been also described in oocytes [11] and in different types of neurons in supraoptic, paraventricular and arcuate nuclei [1, 6, 10, 12].

The appearance and the functional significance of the NLBs or nematosomes in the cytoplasm have been discussed as a result of RNA export from the nucleus to the cytoplasm [14] and as an expression of early action of various regulatory factors. M o r a l e s and B l o o m [9] pointed out by light and electronmicroscopical autoradiography vasopressin mRNA in a subset of axonal swellings in median eminence and posterior pituitary.

In this study the nucleolus-like bodies were described in the cytoplasm of hypothalamic neuroendocrine cells and the ovarian granulosa cells, during their functional critical periods and/or in the phases when their specific protein synthesis was increased.

Material and Methods

Female Wistar rats weighing between 200 and 300 g (3 months aged) were used. The tissue specimens embedded in Durcupan for electronmicroscopic study were taken from: 1. Nucleus arcuatus and median eminence of pregnant rats at mid pregnancy and one day for parturition; 2 Subfornical organ of lactated animals; 3. Ovarian granulosa cells from antral follicles. The electronmicroscopical observation was made by EM OPTON and Zeiss.

Results

The ultrastructural features observed in our study in arcuate and subfornical neurons and in granulosa cells were similar. The NLBs usually were consisting of round mass of unbounded granular and filamentous material without a preferential situation in the cytoplasm (Fig. 1). The inclusions of NLBs varied in density but were more lighter as the nucleolus. Some of nematosomes were homogeneous (Fig. 2), the other ones possessed small clearings (Fig. 3a, b, c), or large pale central district with the same density as the surrounding cytoplasm. NLBs were only occasionally seen in dendrites.

In some of investigated cells an alignment of numerous compact nucleolar bodies were observed tightly to the nuclear envelope, containing numerous pores (fig. 4). Perinuclear cisternal spaces were seen (Fig. 5). Some of these cisterns were without any structures in it, but in many perinuclear spaces nucleolar material was available.



Fig. 1. Nucleolus-like body in the perikaryon of nerve cell of rat arcuate nucleus at the end of pregnancy ($\times 10\ 000$)

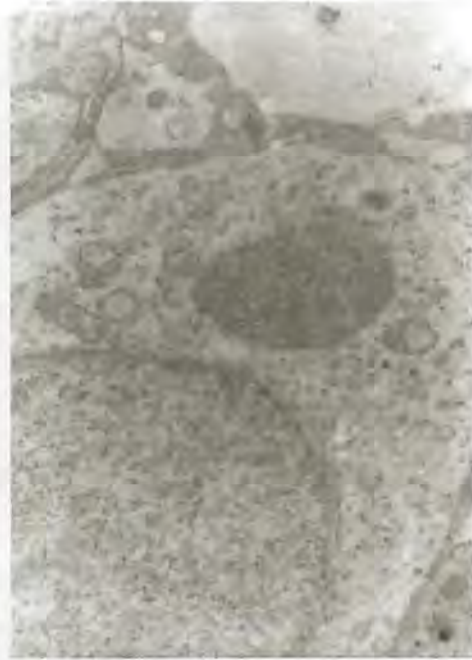


Fig. 2. Homogeneous NLB in the cytoplasm of nerve cell of the subfornical organ of lactated rat ($\times 10\ 000$)

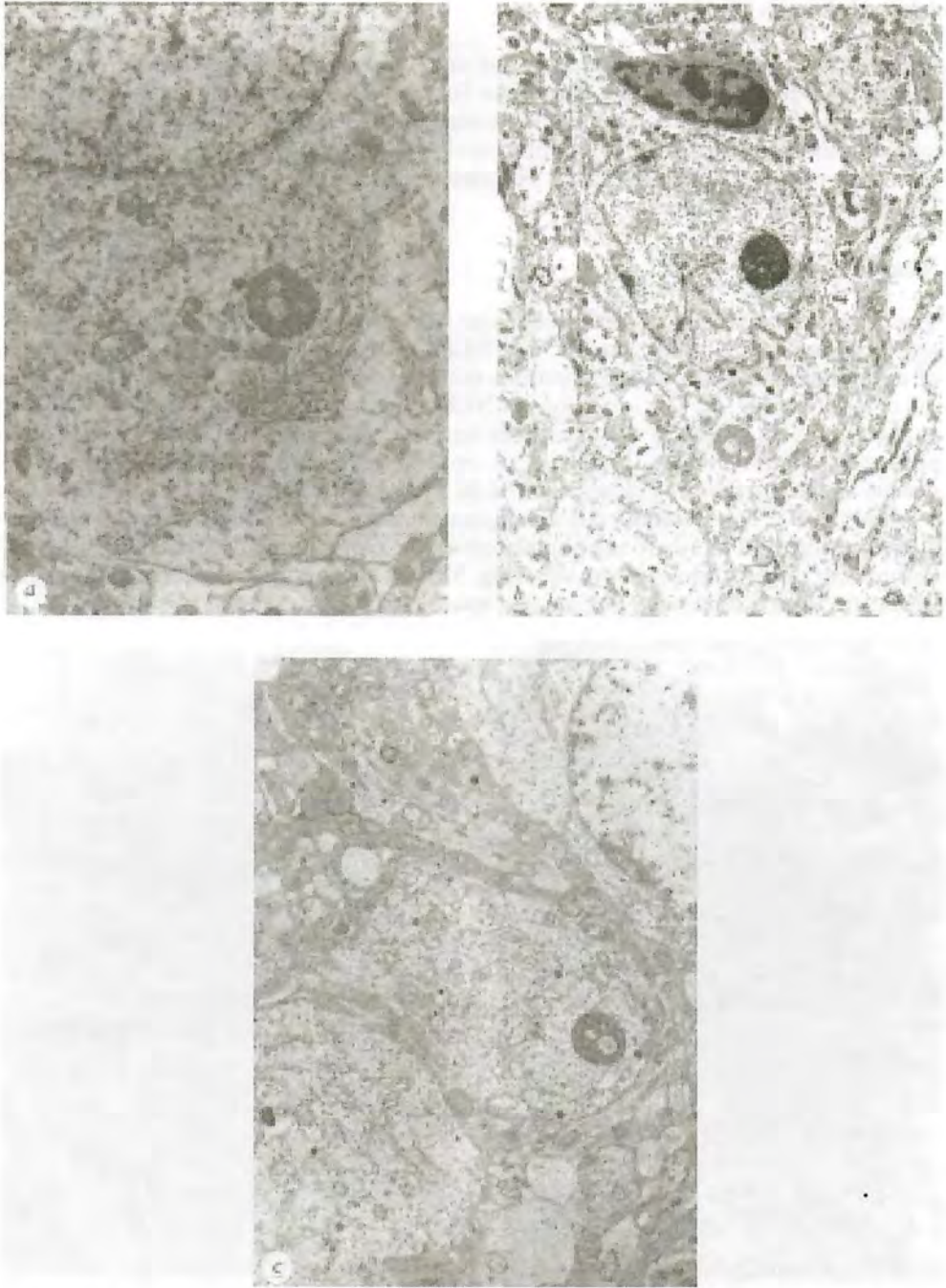


Fig. 3. NLBs with electron light zones in the cytoplasm of arcuate neurons. The granular endoplasmic reticulum is well developed (*a* - $\times 10\ 000$; *b* - $\times 6\ 000$; *c* - $\times 6\ 000$)



Fig. 4. Ovarian granulosa cell of rat antral follicle. Electron dense particles are situated closed to the nuclear envelope. NLB with numerous polyribosomes around it ($\times 12\ 000$)



Fig. 5. Nerve cell of arcuate nucleus at the end pregnancy with perinuclear cisternae and polyribosomes. Prominent NLB ($\times 20\ 000$)

Discussion

The nucleolus-like bodies described in this study were founded in rats' neuroendocrine and ovarian granulosa cells, when their protein synthesis has been physiologically activated. The arcuate neurons were investigated at the end of pregnancy, when an increased phasic secretion of the gonadotrophin releasing hormone is present [15]. The neurons of the subfornical organ were activated too in relation with the lactation [2]. The ovarian granulosa cells, especially these in cumulus oophorus are engaged in the secretion of follicular fluid.

Our data are in accordance with the opinion of the presence of the nucleolus-like bodies or nematosoma [4] in cells with augmented metabolic needs [7]. In the stimulated *in vitro* by relaxin (a member of insulin-like family of hormones) ovarian granulosa cells, an increased DNA/RNA synthesis and cell proliferation (cell colonies and cluster formation) has been obtained as well as the presence of probable NLBs in the cytoplasm [3]. It was supposed that the components of the NLBs represent ribonuclear material. The most of authors considered that these cytoplasmic inclusions originate from the nucleus [8] or a nucleo-cytoplasmic transport is present. The fine structure of the perinuclear area (nucleolar bodies near the nuclear envelope) seen in this study confirmed this concept.

The studies of V a z q u e z - N i n et al. [14] by light and electronmicroscopic autoradiography on the effect of hypophyseal hormones on the transcription and

RNA export to the cytoplasm pointed out that these hormones exert like steroid hormones similar effects on their target cells, inducing a rapid export of nuclear RNA to the cytoplasm using different pathways mediating this process.

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