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Microtubules in Thyroidectomy Cells of the Rat Anterior Pituitary Gland[1] (38812)

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Previously we reported a fixation procedure for the preservation of microtubules in the prolactin cells of the rat anterior pituitary gland (1). By using this procedure it is possible to see microtubules (as well as microfilaments) not only in prolactin cells but also in other cell types in anterior pituitary glands of normal rats. We have observed that the thyrotroph contains relatively many microtubules, and that thyroidectomy induces a more prominent appearance of microtubules in thyrotrophs. In thyroidectomy cells, numerous microtubules are present; this suggests a close relationship between microtubules and cellular functions.

Materials and Methods. Male rats (Sprague–Dawley) were surgically thyroidectomized at 40 days of age. As controls, male rats of the same age were sham-operated. The animals were kept in an air-conditioned room under controlled lighting (14L:10D) for 1 wk after the operation. They were killed by decapitation, and the anterior pituitary gland was exposed immediately, cut into small pieces, and placed into the fixative. The fixation and other procedures for electron microscopy followed our previously reported method (1).

Results. The procedures used in this study revealed numerous cytoplasmic microtubules in thyrotrophs (Fig. 1) as well as in prolactin cells and somatotrophs. However, microfilaments were generally most numerous in the nongranular follicular cells, and they were relatively scarce in most of the secretory cells.

Microtubules were recognized throughout the cytoplasm of thyrotrophs, and they were more frequently observed in the same type of cell after thyroidectomy, i.e., the developing thyroidectomy cell (Fig. 2). In thyroidectomy cells, the distribution of microtubules was similar to that of normal thyrotrophs, e.g., they were seen in contact with or in close proximity to endoplasmic reticula (Fig. 2), mitochondria (Fig. 3), and Golgi components (Fig. 4). This is similar to the distribution pattern we described for microtubules in the prolactin cell (1).

Discussion. Recently, many investigators have discussed the proposed functions of microtubules and microfilaments in many kinds of cells (2–9). In regard to anterior pituitary cells, several investigators have reported the presence of microtubules and considered the possibility that these structures are involved in secretory processes (10–12). These investigators have demonstrated microtubules in somatotrophs and prolactin cells, but their role in the cell is still uncertain. One reason for this situation may be the fact that until recently we have not had an adequate technique for preserving microtubules and microfilaments of the cells of the anterior pituitary gland.

To our knowledge, there has been no report which has illustrated microtubules in the thyrotroph or in thyroidectomy cells. We have now successfully demonstrated microtubules in these cells as well as in prolactin cells and somatotrophs.

It is generally accepted that thyroidectomy cells are hyperactive cells which originate from thyrotrophs (13–15). Degranulation of thyrotrophs and the appearance of thyroidectomy cells take place rapidly after removal of the thyroid gland. Although there are still many questions as to the role of microtubules in the anterior pituitary cells, the occurrence of numerous microtubules in early stages of development of thyroidectomy cells may suggest a close relationship between microtubules and cellular functions associated with the hypersecretory state.

Summary. Microtubules were successfully illustrated in thyrotrophs and thyroidectomy cells of rat pituitary glands. In con-

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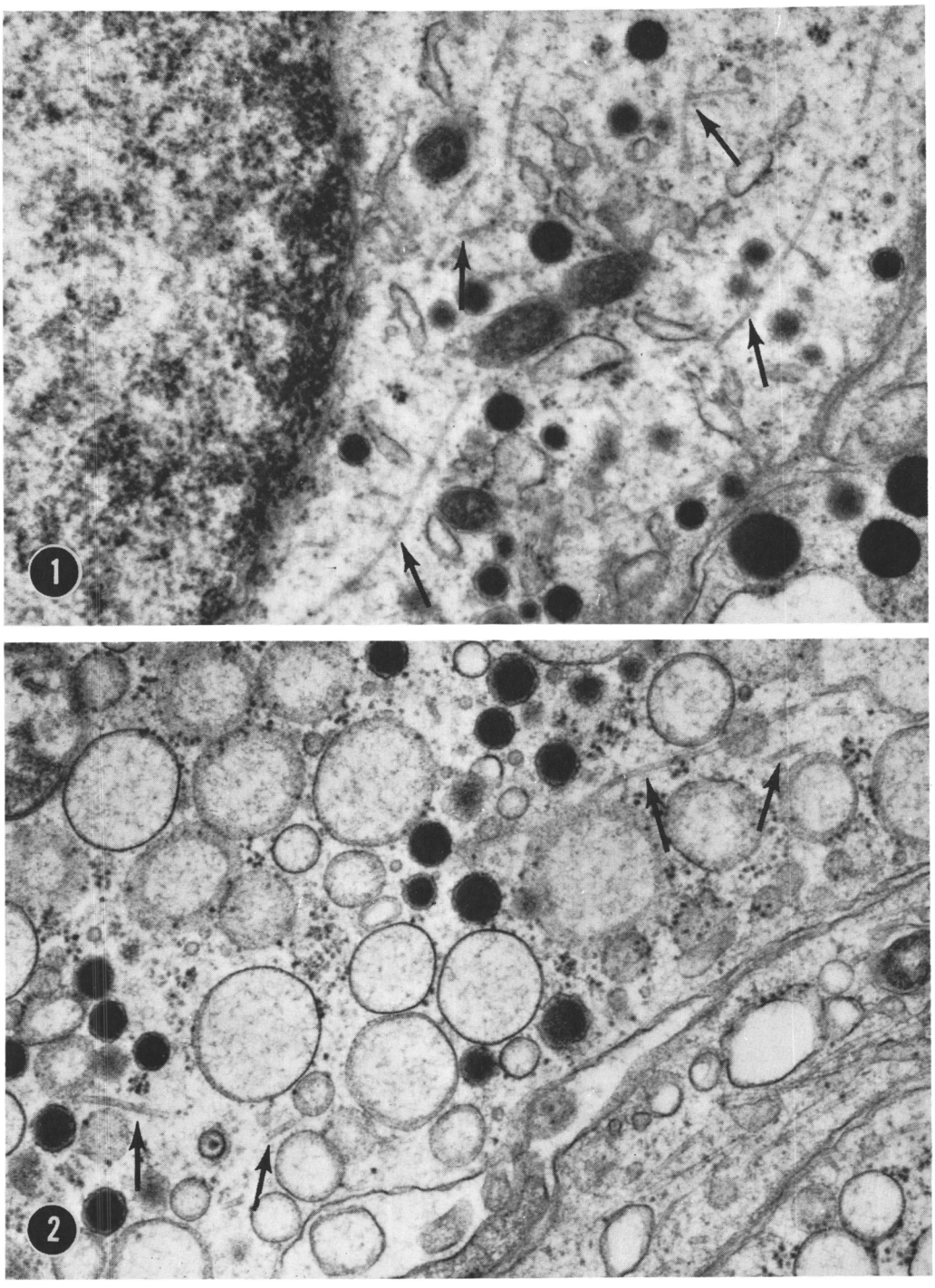
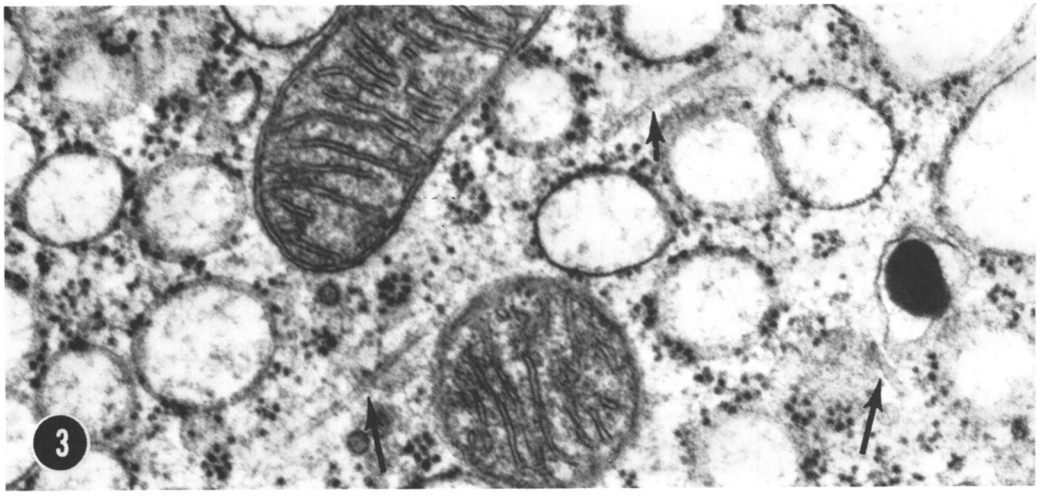


FIG. 1. An example of a thyroidectomy cell thought to represent an early stage in the cellular modification which follows thyroidectomy. Arrows indicate microtubules (×37,000).

FIG. 2. Microtubules (arrows) located among swollen endoplasmic reticula and secretory granules of a thyroidectomy cell. In the lower right portion of the figure is a cytoplasmic process of a follicular cell. This cell process contains numerous microfilaments as well as microtubules (×45,000).



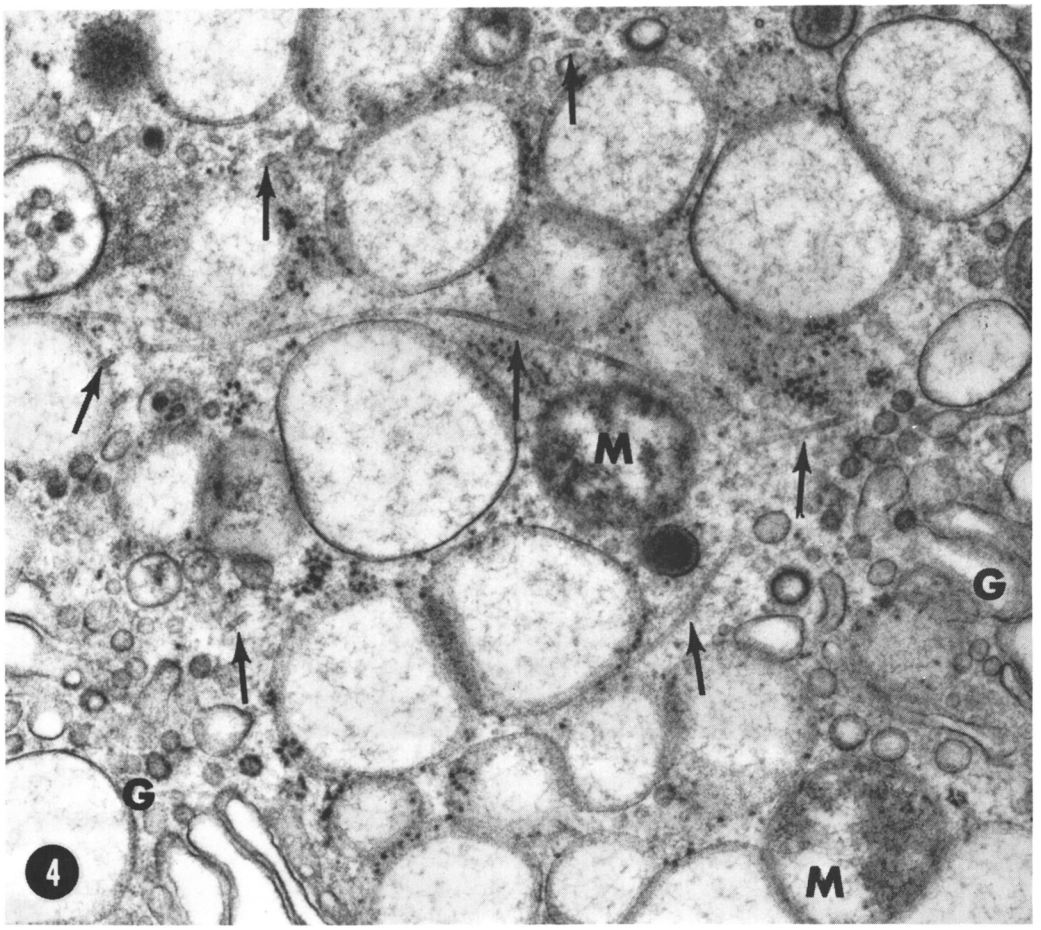


FIG. 3. Microtubules (arrows) in close proximity to two mitochondria of a thyroidectomy cell (×55,000).

FIG. 4. Microtubules (arrows) in the vicinity of the Golgi complex of a thyroidectomy cell. G: Golgi zone M: Mitochondria. (×44,000).

trast, microfilaments were mostly seen in the nonglandular follicular cells. Numerous microtubules were observed in the early stages of development of the thyroidectomy cell. In thyroidectomy cells microtubules were located in close proximity to mitochondria, endoplasmic reticula, secretory granules, and membranes of Golgi complexes. Consequently, it is suggested that microtubules may play a role in degranulation or other processes associated with the hypersecretory state.

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