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Intercellular channels in the canine and porcine thyroid gland

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INTRODUCTION

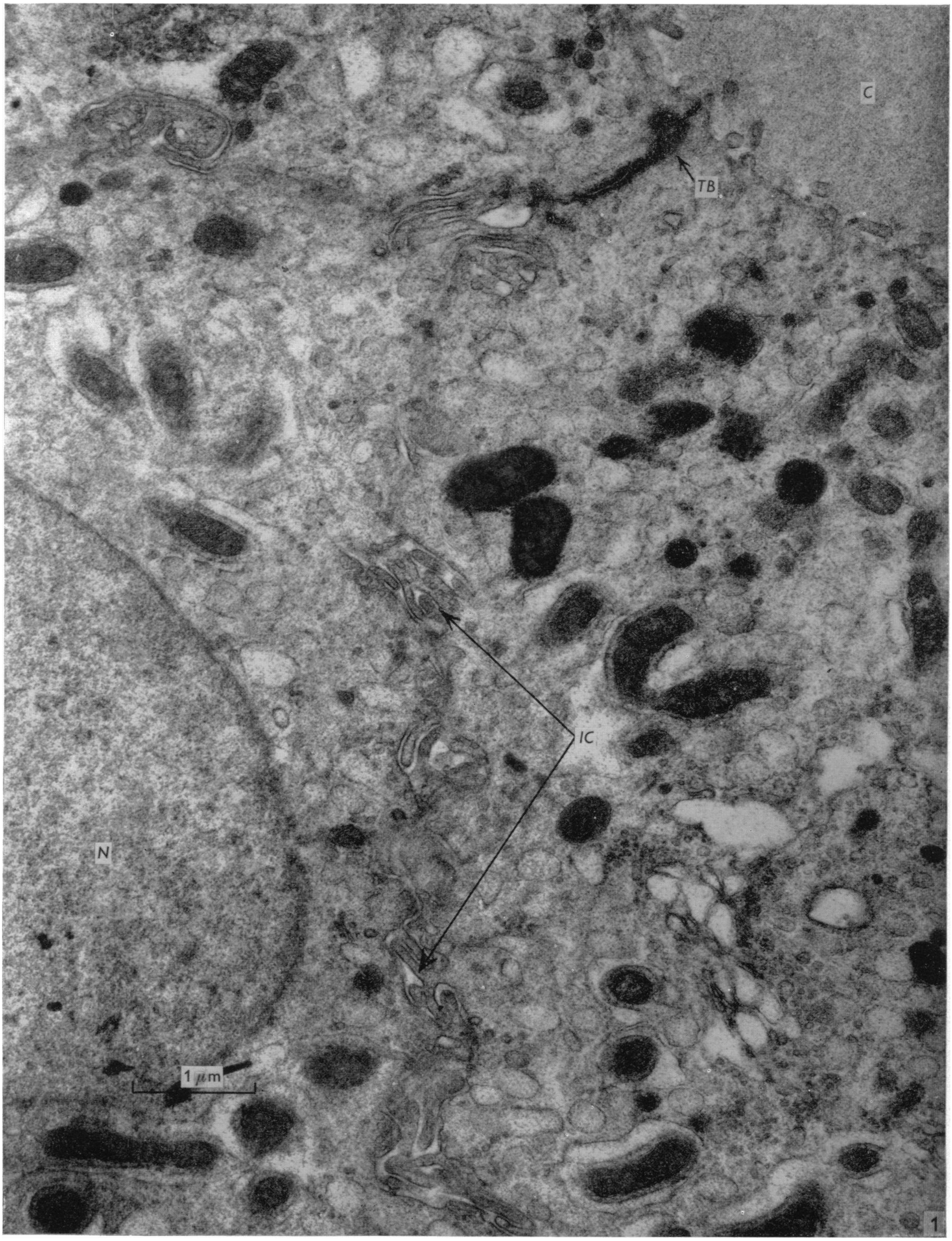
Electron-microscopic studies of the thyroid gland have revealed a striking similarity of fine structure in different species (see Wissig, 1960; Harrison, Rowlands, Whitting & Young, 1962; Young & Leblond, 1963; Fujita & Machino, 1965). The only microscopical differences between species apparently are those related to the activity of the gland (Young, 1962) and include such variations as cell height, size of follicle and density of colloid (Wissig, 1964). Irie (1960) reported differences in length of the microvilli in various species and Fujita & Machino (1965) reported that the follicular cells of a fish (*Seriola quinqueradiata*) had fewer microvilli than those of higher vertebrates.

MATERIALS AND METHODS

Thyroid glands were removed from four adult dogs under anaesthesia produced by intravenous nembutal. Small pieces of gland were then placed into ice-cold 1% osmium tetroxide buffered with veronal (Palade, 1952). Thyroids were also obtained from three 10-week-old pigs under halothane anaesthesia (see Care, 1965) and fixed in 1% osmium tetroxide buffered with veronal in a balanced salt solution (Franchi & Mandl, 1964). After fixation for 2 h the blocks were dehydrated in alcohols and embedded in Araldite. Ultrathin sections were cut on a Porter–Blum microtome and mounted on carbon-coated grids. The sections were stained with uranyl acetate (Stempak & Ward, 1964) before viewing in a Siemens Elmiskop 1 electron microscope.

RESULTS

The general appearances of the thyroid glands are similar to those described in other species. Two types of epithelial cells are present: the more common follicular cells and the rarer light cells (Young & Leblond, 1963). However, in these two species well-marked intercellular channels formed by the separation of the lateral plasma membranes exist below the terminal bars of adjacent follicular cells (Fig. 1.). The channels are about 0·5 μm across, contain numerous crowded microvilli and may extend as far as the basement membrane. At the base of the cells the channels appear to widen and are often associated with the basal processes of adjacent cells. The channels which occur between follicular cells and between follicular cells and light cells are too small to be seen with the light microscope.


C
TB
IC
N
1 μm
1

DISCUSSION

In the developing thyroid gland of the rat, connective tissue spaces are seen between the follicular cells of the 17-day-old foetus (Feldman, Vazquez & Kurz, 1961). As gestation proceeds, however, and the size and number of follicular lumens increase, these spaces disappear. Intercellular canaliculi have been described by Irie (1960) in 4-month-old human foetal thyroids and in women suffering from 'Basedow's disease'. These channels appeared as simple dilatations of the intercellular spaces without microvilli. Irie considered that these channels were not seen under physiological conditions in adults and were limited to pre-natal life. In rats suffering from severe, chronic propylthiouracil stimulation (Wissig, 1964), the basal processes of the follicular cells become more complex and numerous. The basal plasma membrane forms invaginations into the cytoplasm, which do not, however, reach the level of the nucleus. The functional significance of these changes was not known. In glands acutely stimulated with thyrotrophic hormone no such changes are seen (Wissig, 1963).

The intercellular channels reported in this paper are much more extensive than hitherto reported and characteristically appear just below the terminal bar region. There is no evidence that they form functional channels opening into the perivascular space. As the intercellular channels are seen in adult dogs they do not appear to be directly related to maturation of the gland. Moreover, it is difficult to relate their presence to over-activity of the follicular cells as they were not noted in stimulated rat thyroids (Wissig, 1963, 1964) nor in the glands from seal pups known to be in an active phase (Harrison *et al.* 1962). They are also seen both in low inactive epithelium and the more active columnar type of epithelium so their formation does not appear to be directly related to an alteration of cell size.

Similar channels are seen in a variety of different tissues, for example, placental trophoblast (Harrison & Young, 1966) and bile canaliculi (Steiner, 1961) and are usually interpreted as part of a transport system. It is known that the intercellular space is involved in the transport of fat across the epithelium of the small intestine (Palay & Karlin, 1959). The intercellular channels described in this paper therefore could participate in the passage of thyroid hormones from the follicular cells to the perifollicular capillary.

SUMMARY

Well-defined intercellular channels are described in the thyroid gland of the dog and the pig. The significance of these channels as part of a transport system is discussed.

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Fig. 1. Electron micrograph of follicular cells from the thyroid gland of a 10-week-old pig. Well-marked intercellular channels extend from the terminal bar region into the follicular cell cytoplasm. × 20000. *IC*, Intercellular channel; *TB*, terminal bar; *C*, colloid; *N*, nucleus.

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