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Enzyme Histochemical Studies on the Parathyroid Gland and Thyroid C-cells in the Common Dolphin (*Delphinus Delphis*)

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Summary

Parathyroid and thyroid glands of five common dolphins (*Delphinus delphis*) were studied by enzyme histochemistry (NADH-DH, NADPH-DH, α-GPD, SDH, β-HBD, ALPase and ACPase). The parenchymal cells of the parathyroid glands are composed of lobular structure. The gland cells showed an intense histochemical reaction for α-GPD, a strong reaction for NADH-DH, moderate for NADPH-DH, low for SDH and ACPase, and negative for β-HBD and ALPase. A positive reaction for ALPase in the parathyroid glands was observed in the vascular walls.

The C-cells of the dolphin thyroid gland reacted intensly for α-GPD. The enzyme reaction was a good marker of the C-cells among the enzymes tested, though the reaction in the follicular cells noticed to be strong to weak. The α-GPD positive C-cells were present mainly in single or pair cells in intrafollicular position but not in interfollicular space. The parathyroid glands and thyroid C-cells of dolphin which has light and spongy bones, were not different from those of other mammalian species in histochemical properties.

Comparative enzyme histochemical studies on parathyroid glands and C-cells have been described in many mammalian and avian species, but never in the cetaceans (1–4). The bones of marine mammals show specializations related to the marine life. The sirenians have very dense bones (5) whereas cetaceans have lighter, spongy bones without a marrow cavity (6, 7). The light cells have been identified by light microscopy in the thyroid glands of North Pacific pilot whales, (*Globicephata scammoni*) and Atlantic pilot whales (*Globicephala melaena*) (8), and by electron microscopy in the common dolphin (*Delphinus bairdi*) (9)

The present study deals with the enzyme histochemistry reactions of the parathyroid gland and thyroid C-cells in the common dolphin.

Materials and Methods

Parathyroid and thyroid glands were obtained from five female dolphins (*Delphinus delphis*). After slaughter, the glands were quickly frozen in a mixture of acetone and dry ice. Cryostat sections (8 μm) were mounted on clean slides and dried at room temperature for 10 min. The method ued for demonstrations of NADH dehydrogenase (NADH-DH) and NADPH dehydrogenase (NADPH-DH) were those of Barka-Anderson (10). Sections were incubated for NADH-DH and NADPH-DH for 40 min at 20°C. The activity of succinate dehydrogenase (SDH) was demonstrated by the method of Nachlas et al (11). Sections were incubated for 40 min at 37°C. The activities of α-glycerophosphate dehydrogenase (α-GPD) and β-hydroxy butyrate dehydrogenase (β-HBD) were demonstrated in the method of Pearse (12). Sections were incubated for α-GPD and β-HBD for 60 min at 37°C. The activities of nonspecific alkaline phosphatase (ALPase) and acid phosphatase (ACPase) were demonstrated in the method of Burstone (13). Sections were incubated for ALPase for 30 min and for ACPase for 40 min at 20°C.

Results

Parathyroid gland

The parenchymal cells of the parathyroid gland were surrounded by connective tissue elements and composed of lobes with a diameter between 60 and 300 μm. The enzyme reaction in the parenchymal cells were intense for α-GPD, strong for NADH-DH, moderate for NADPH-DH, low for SDH and ACPase, and negative for β-HBD and ALPase (Fig, 1a-f). The reaction of ALPase in the vascular walls was observed in the arteriole and capillary.

Thyroid C-cells

The thyroid gland of the common dolphin was made up of small, often irregular follicles with a diameter between 30 and 70 μm. The reaction of NADH-DH was strong in C-cells and follicular cells (Fig. 2a). The reaction of NADPH-DH was strong in C-cells and folicular cells (Fig. 2b). The reaction of α-GPD was intense in the C-cells, though this reaction showed variation from strong to weak in the follicular cells (Fig. 2c). The α-GPD positive C-cells were present mainly singly or in pairs in intrafollicular position, but not in interfollicular position. The reaction of SDH was low in the C-cells as well as in the follicular cells (Fig. 2d). The reaction of ALPase was not found in the C-cells and follicular cells. Only positive reactions were observed in the walls of the arteriole and capillary (Fig. 2e). The reaction of ACPase was observed in the apical cytoplasm of the follicular cells, but not in the C-cells (Fig. 2f).

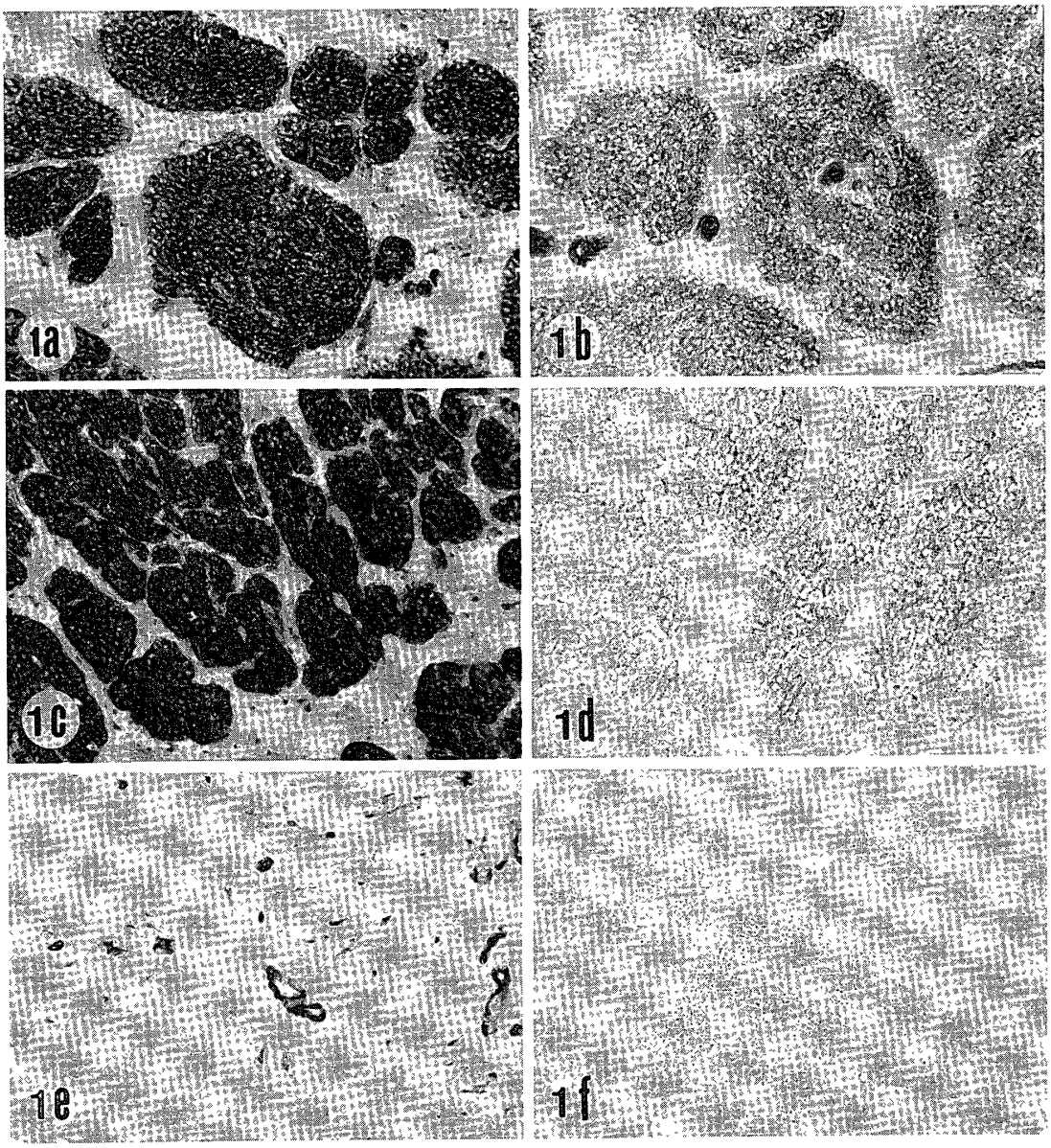

FIG. 1a-f. Six enzyme reaction in the parathyroid gland of the common dolphin. (a) NADH-DH, (b) NADPH-DH, (c) α-GPD, (d) SDH, (e) ALPase, (f) ACPase. ALPase reaction is observed in blood vessels. × 132.

Discussion

Parathyroid gland Cells

The arrangement of the gland cells of the common dolphin is similar to that of pig parathyroid cells which are separated by connective tissue and composed of lobular structure (3). The enzyme reactions in the dolphin cells are similar to those in the goat, but not so to those in the pig (3, 4). ALPase reaction was positive in the walls of the arteriole and capillary of the dolphin and goat parathyroid gland cells, whereas it is positve only in those of the arteriole of the pig (3, 4).

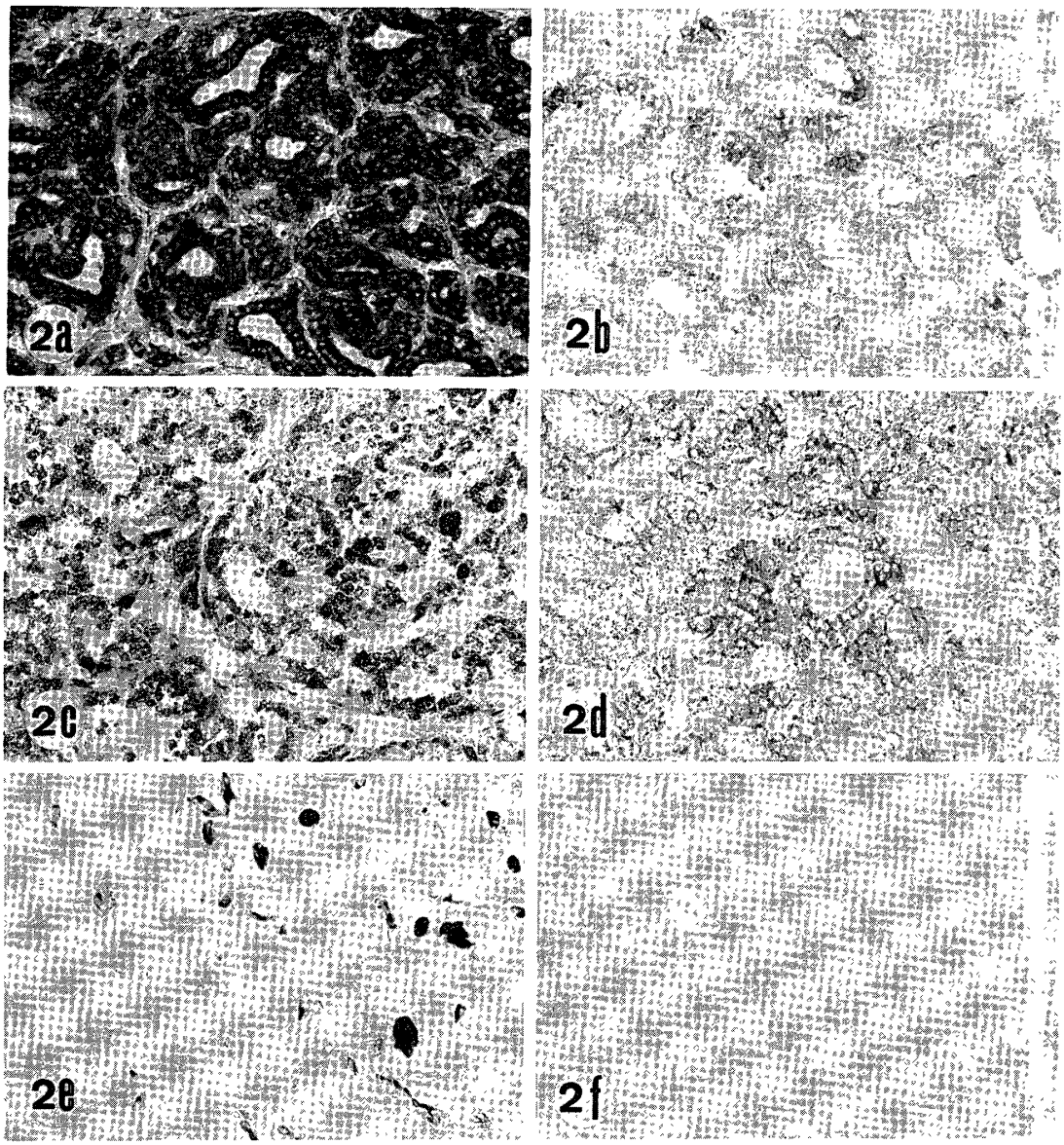

FIG. 2a-f. Six enzyme reactions in the thyroid gland of the common dolphin. (a) NADH-DH, (b) NADPH-DH, (c) α-GPD, (d) SDH, (e) ALPase, (f) ACPase.-GPD reaction is intense in the C cells, though this reaction shows a variation from strong to low in the follicular cells. × 132.

Thyroid C-cells

Pearse (1) showed that the C-cells of the dog, pig and man dipslay a high activity of α-GPD. Other reports also indicated that α-GPD is in fact a good marker of the C-cells in the thyroid glands of mammalian species (mouse, cat, sheep, donkey, cow, etc.) (14–20). However, in the rat (21, 22), rabbit (23) and guinea pig (24), the α-GPD is useless as the marker of the C-cells. Sawicki showed that SDH proved to be least effective as a C-cell marker, α-GPD being better, and ACPase and non-specific esterases the best (not in the rat thyroid) in 26 animals belonging to 5 rodent species (24).

In this study, α-GPD was only a good marker of thyroid C-cells among the enzymes tested. Young and Harrisson (8, 9) revealed that the light cells have been identified by light microscopy in the thyroid glands of North pacific pilot whales (*Globicephala scammoni*) and Atlantic pilot whales (*Globicephala melaema*), and by electron microscopy in the dolphin thyroid. They observed that the C-cells in the dolphin thyroid gland were oval in shape, singly or in pairs in intrafollicular position. Sometimes they lay between follicular cells, often between the intercellular spaces.

In this study, the C cells as revealed by α-GPD, were located mainly in intrafollicular position same as Young and Harrison's results but not that C-cells possesed long protrusions.

The bones of marine mammals show specializations related to their marine life. Cetaceans have lighter spongy bones without a marrow cavity (6, 17). In this study, however, the enzyme histochemical properties of parathyroid gland and thyroid C-cells in the common dolphin did not reveal the difference from those of the other terrestrial mammals (3, 4).

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