Japanese Journal of Ichthyology
Vol. 26, No. 1 1979

魚類学雑誌
26巻1号 1979年

Fine Structure of the Small and Large Mucous Cells Found in the Skin Epidermis of Two Cottids, *Pseudoblennius cottoides* and *Furcina* sp.

Mitsuo Satō

(Received October 28, 1978)

Abstract From differences in size and cytoplasmic features, the mucous cells of two cottids, *Pseudoblennius cottoides* and *Furcina* sp., are divided into two distinct types, i.e. small and large mucous cells. The fine structure of these two types, however, shows no gross differences between the two species. As in the majority of mucous cells, small mucous cells possess well-developed rough-surfaced endoplasmic reticula and a considerable number of Golgi complexes, and thus mucogenesis of these cells seems to be performed by cooperation of the above-mentioned two organelles. Large mucous cells, contrary to the former type, have no well-developed rough-surfaced endoplasmic reticula, but a number of Golgi complexes and an abundance of mitochondria. Accordingly, formation of mucous droplets in large mucous cells is conjectured to be carried out by somewhat different process from that of small mucous cells. In this case, Golgi complexes probably have the most important role. The presence of desmosomal attachments between the large mucous cells and adjacent filament-containing cells may be noticeable. The contents of these two types of mucous cells seem to be not very different from each other. The skin epidermis of the present two cottids is endowed with sacciform granulated cells in addition to the above-mentioned two secretory glands.

As Henrikson and Matoltsy (1968), Harris and Hunt (1975) and other authors already pointed out, the most commonly encountered unicellular glands in teleostean skin are epidermal mucous cells which generally originate in the basal layer of the epidermis and migrate towards the surface layer as they develop, thus discharging their product there. In the majority of bony fishes, each species has its respective mucous cells which are usually of a single type showing no distinguishable differences in morphological structure and chemical components at the mature stage. Merriless (1974), however, found electron microscopically two types of mucous cells in skin epidermis of *Esox americanus*: a typical gobletlike mucous cell and another type not previously described for teleosts. Asakawa (1970) and Yamada and Yokote (1975) divided mucous cells of the Japanese eel, *Anguilla japonica*, into two well differentiated cell types, based on histochemical analysis of mucosubstances of these cells. Kitzan and Sweeny (1968) classified the epidermal goblet cells of a dipnoan fish, *Protopterus annectens*, into three types from the different staining reaction to PAS, and also into three types according to size and electron opecity of the mucous droplets.

In a previous paper (Satō, 1978), the author stated that two kinds of mucous cells i.e. small and large were found in the skin epidermis of a cottid, *Pseudoblennius cottoides*. Later, two types of similar mucous cells were also recognized in the skin epidermis of another cottid, *Furcina* sp. That these two kinds of mucous cells show differences not only in their size but also in their fine structure has been ascertained by the present electron microscopy. Investigation of the ultrastructure of epidermal mucous cells of teleosts is comparatively recent, and has been performed by Wellings et al. (1967), Henrikson and Motoltsy (1968), Hawkes (1974), Lanzing and Wright (1974), Leonard and Summers (1976), Ferri et al. (1977) and others.

Materials and methods

Two cottids, *Pseudoblennius cottoides* (Richardson) and *Furcina* sp., measuring about

10 cm in total length, were obtained from the seashore of Fukaura-machi, Aomori Prefecture. Methods employed for the present electron microscopy were the same as those described in a previous paper (Satō, 1978). In addition, 6.25% glutaraldehyde buffered at pH 7.4 with Millonig's phosphate and 1% osmium tetroxide buffered at pH 7.4 with Palad's veronal-acetate were respectively used for pre- and post-fixation of some skin pieces of *P. cottoides*. Semi-thin sections of 1～2 μm were also cut for light microscopy. These sections were stained with 0.5% toluidine blue solution or with Kurotaki's polychromatic staining method for epon-embedded tissue (Kurotaki, 1972). PAS, alcian blue 8GS test, and mucicarmine test were performed in paraffin sections prepared by routine histological procedures.

Results

In light microscopy, the small and large mucous cells of the two cottids were easily distinguished by their morphological aspects. The former at the mature stage were generally situated in the upper half, and especially the outer layer, of the epidermis, and were slightly elongated oval or pear-shaped. It measured about 4～9 μm in basal diameter and about 6～15 μm in height. Their contents were stained greenish blue with alcian blue and red with mucicarmine, respectively, but gave relatively weak positive reactions to the PAS test (Fig. 1B). Mature large mucous cells occupied approximately two-thirds or nearly the entire height of the epidermis. They were oval, pear- or flask-shaped, with variable sizes according to their maturity. They measured about 25～30 μm, some acheiving about 50 μm in basal diameter and about 50～70 μm in height. Large mucous cells contained a product which gave an intense color reaction to PAS (Fig. 1A, B), but took a lighter tint than small mucous cells with the above-mentioned two stainings. The contents of both the small and large mucous cells, however, were similary stained reddish violet with Kurotaki's polychromatic staining. Although precise distribution of these two mucous cells was not fully ascertained on the whole body surface of the two cottids, these mucous cells were much more prevalent in *Furcina* sp. Generally, the number of small mucous cells exceeded that of large ones in both the cottids.

As the fine structure of small and large mucous cells of *P. cottoides* corresponded respectively to that of each of *Furcina* sp., the following descriptions were based mainly on the results obtained in the former species and were partialy supplemented by observations on the latter one.

The small mucous cell: Early developmental stages of this cell were not observed. The younger or nearly mature cells were readily recognized from filament-containing cells by their cellular organelles and mucoid substances isolated in discrete packets which

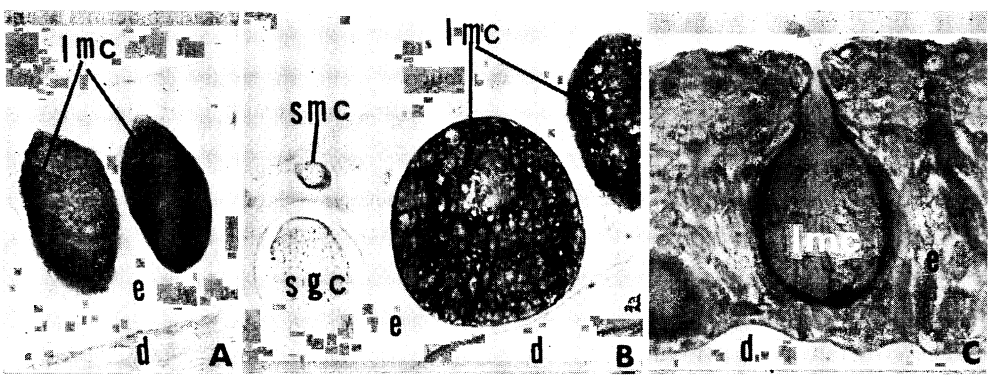

Fig. 1. Section through the skin epidermis of two cottids, *P. cottoides* (A) and *Furcina* sp. (B and C), showing unicellular mucous cells. A and B, stained with PAS technique; C, thick epon section stained with toluidine blue. A, × ca. 350; B, × ca. 400; C, × ca. 450. d, dermis; e, epidermis; lmc, large mucous cell; sgc, sacciform granulated cell; smc, small mucous cell.

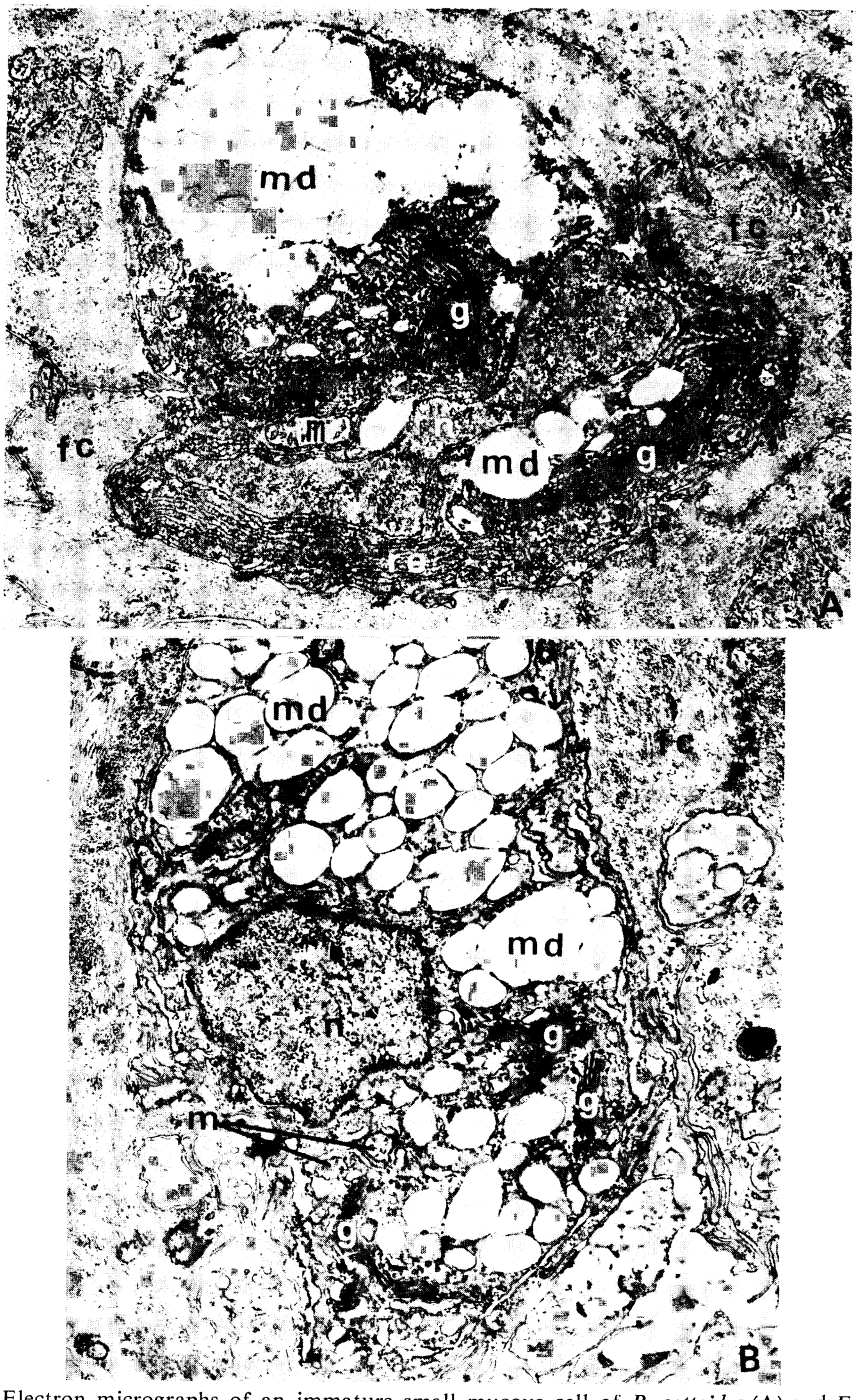

Fig. 2. Electron micrographs of an immature small mucous cell of *P. cottoides* (A) and *Furcina* sp. (B). A, ×10,000; B, ×9,000. fc, filament-containing cell; g, Golgi complex; m, mitochondria; md, mucous droplet; n, nucleus; re, rough-surfaced endoplasmic reticulum.

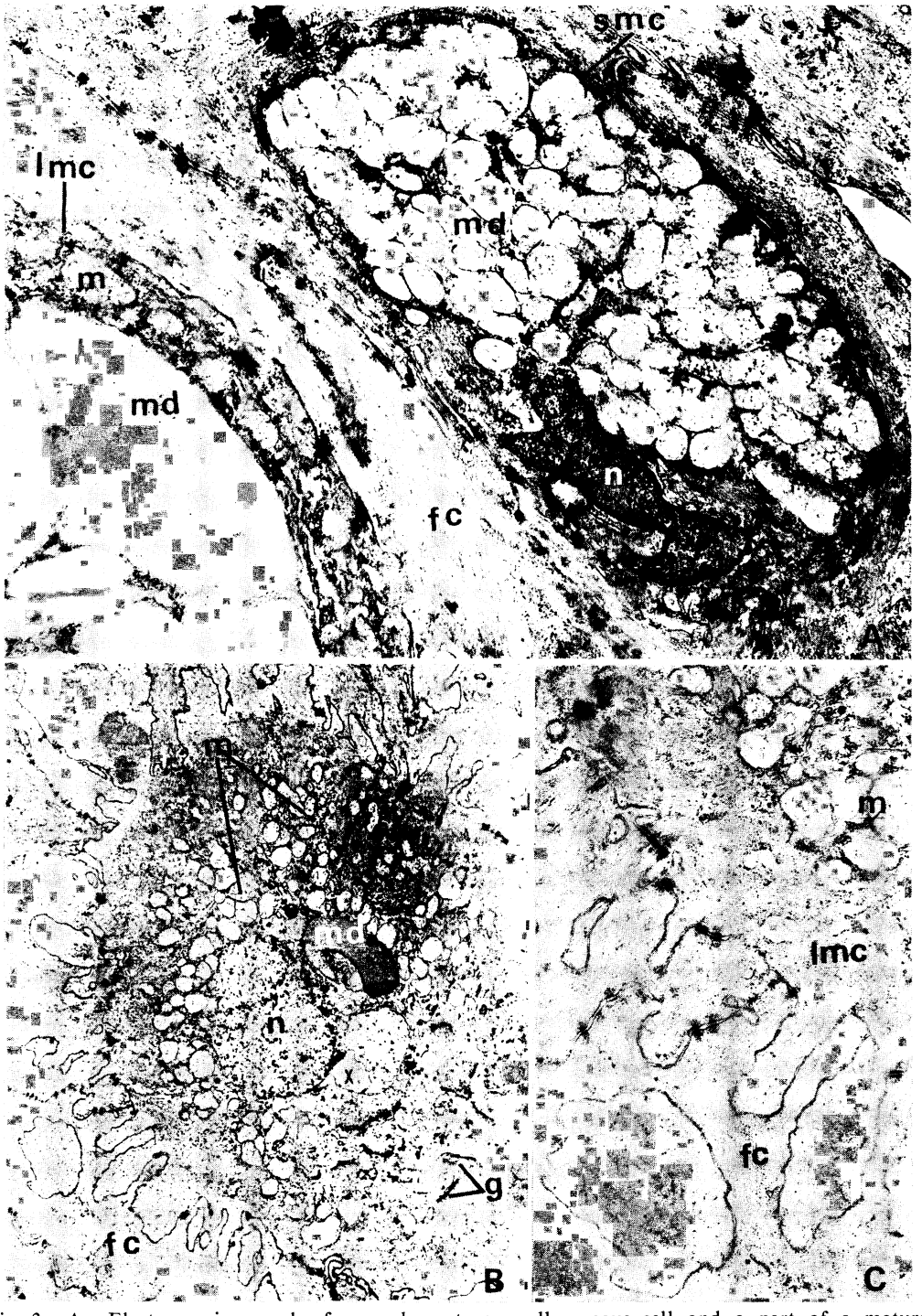

Fig. 3. A. Electron micrograph of a nearly mature small mucous cell and a part of a mature large mucous cell of *P. cottoides*. Note remarkable difference in average size of mucous droplets of the small and large mucous cells. ×13,000. B. Electron micrograph of a very young large mucous cell of *P. cottoides*. ×4,000. C. Higher magnification of the left lower portion of B, showing desmosomes and finger-like projections between the large mucous cell and neighbouring filament-containing cell. ×10,000. x, membrane-limited body. Other letters, vide Figs. 1 and 2.