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Electron Microscopic Observations of the Epithelial Cell of the Digestive Diverticulum in the Oyster, *Crassostrea gigas* Thunberg.

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Summary

The fine structure of the epithelial cells in the oyster, *Crassostrea gigas*, digestive diverticulum is described. The cilium of the ducts, about 6 μ in length and 0.3 μ in width, projects from the distal surface of the ciliated cell to the lumen. The free portion of the cilium is supported by the axial filaments, nine pairs of double peripheral filaments and a pair of central filaments. The ciliated cells are characterized by the scant cell organelles, but mitochondria are well-developed in the apical regions. The light cell is characterized by the presence of many microvilli, about 2.5 μ in length and 0.2 μ in width, forming the brush border. Mitochondria of the light cells are seen scattered in cytoplasm but gathered densely in the apical portion. The supranuclear and apical regions of the light cells are filled with a large number of granules which are round or oval in shape. The dark cell is characterized by the presence of well-developed lamellae, rough-surfaced endoplasmic reticulum.

The digestive diverticulum of the oyster, which has been called liver or hepatopancreas morphologically, is known to surround the stomach. It is well known that the absorption of nutriments and the intracellular digestion are carried on in it, but it has no function of secreting digestives such as the liver and pancreas have (1, 2).

The digestive diverticulum is composed of a large number of blind tubules and several large ducts which lead to the inside of the stomach. The epithelium of the tubules consists of two kinds of cells, while the ducts consist of one kind of cell (1, 2, 3). However, as yet the fine structure of such an organ has not been observed. The present paper will treat the submicroscopic structure of the epithelial cell in the oyster digestive diverticulum.

Materials and Methods

Adult oysters, *Crassostrea gigas*, were obtained from Onagawa Bay, Miyagi Prefecture, during the period from October 1967 to March 1968. Digestive

diverticulum with the connective tissue was dissected out and cut into small pieces. The specimens were fixed for 1 hour in ice cold 1% Osmium tetroxide solution (adjusted to pH 7.3 with sodium phosphate buffer) with glucose added to it. After fixation, the specimens were dehydrated in a series of increasing concentrations of ethanol and embedded in Epon 812 (4).

Sections were cut on a Porter-Blum microtome with a glass knife and stained with 3% aqueous solution of uranyl acetate for 2 hours. A Hitachi HWI electron microscope was used for the observations.

Observations and Discussion

The characteristic features of these three kinds of cells constituting the digestive diverticulum of *Crassostrea gigas* have been observed to be as follows.

The ducts that connect the tubules with the stomach are lined with ciliated epithelium. The epithelium is similar than that of the stomach. Many cilia, about 6 μ in length and 0.3 μ in width, project to the lumen from the distal surface of the ciliated cell. The free porition of the cilium is supported by the axial filaments, nine pairs of double peripheral filaments and a pair of central filaments (Fig. 1). The ciliated cells are characterized by the scant cell organelles such as vesicle and endoplasmic reticulum, but the mitochondria are well-developed in the apical regions. These ciliated cells seem to serve solely for transportation of food and faecal materials, but have no absorptive function.

In the light microscopic observations, one kind of epithelial cell of the tubule, the light cell, has a well vacuolated protoplasm with a large nucleus at their base, while the other kind, the dark cell, has a dark stained protplasm with basic dyes, a compact nucleus and indistinct cell boundaries. The light cell is characterized by the presence of many microvilli, projecting from the cell surface to the lumen of the tubule and forming the brush border (Fig. 2). The longitudinal section of the light cell shows each microvillus to be about 2.5 μ in length and 0.2 μ in width. In cross section they are shown in a close contact with each other, forming a beautiful network. A few cilia are recognized in it (Fig. 3). Sometimes the plasma membrane between the microvilli is shown to invaginate into the cytoplasm and it seems to end in the vesicle. The light cell is columnar and taller than the dark cell. Mitochondria are seen scattered in the cytoplasm but gathered densely in the apical portion. But there seems to be no specific relationship in the distribution of mitochondria to the other organelles. The supranuclear and apical regions of the light cells are filled with a large number of granules which are round or oval in shape (Fig. 4). These granules are always surrounded by a thin membrane and their contents are homogeneous and vary in density in the transitional stages from low to somewhat high.

The dark cell is characterized by the presence of a well-developed lamellae, rough-surfaced endoplasmic reticulum. The present author wishes to give a

detailed statement in the future after discerning its fine structure and its functional significance.

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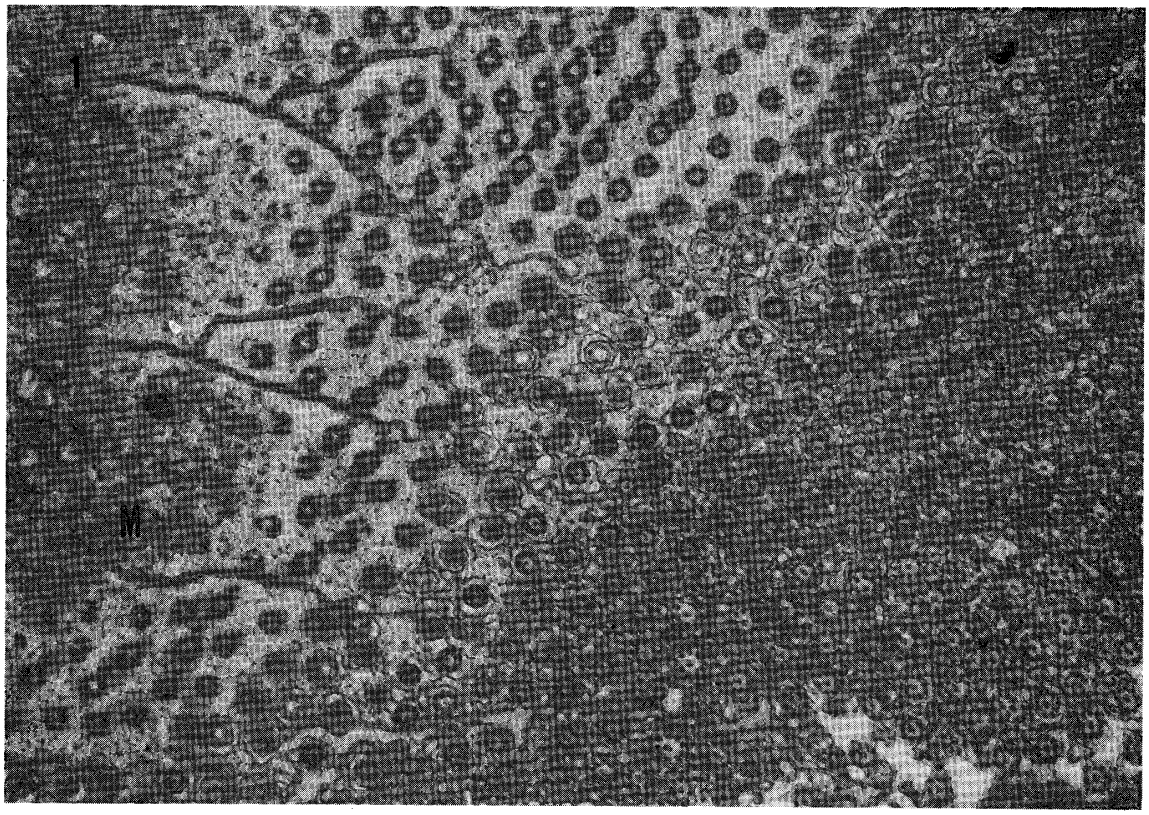
Plate 1

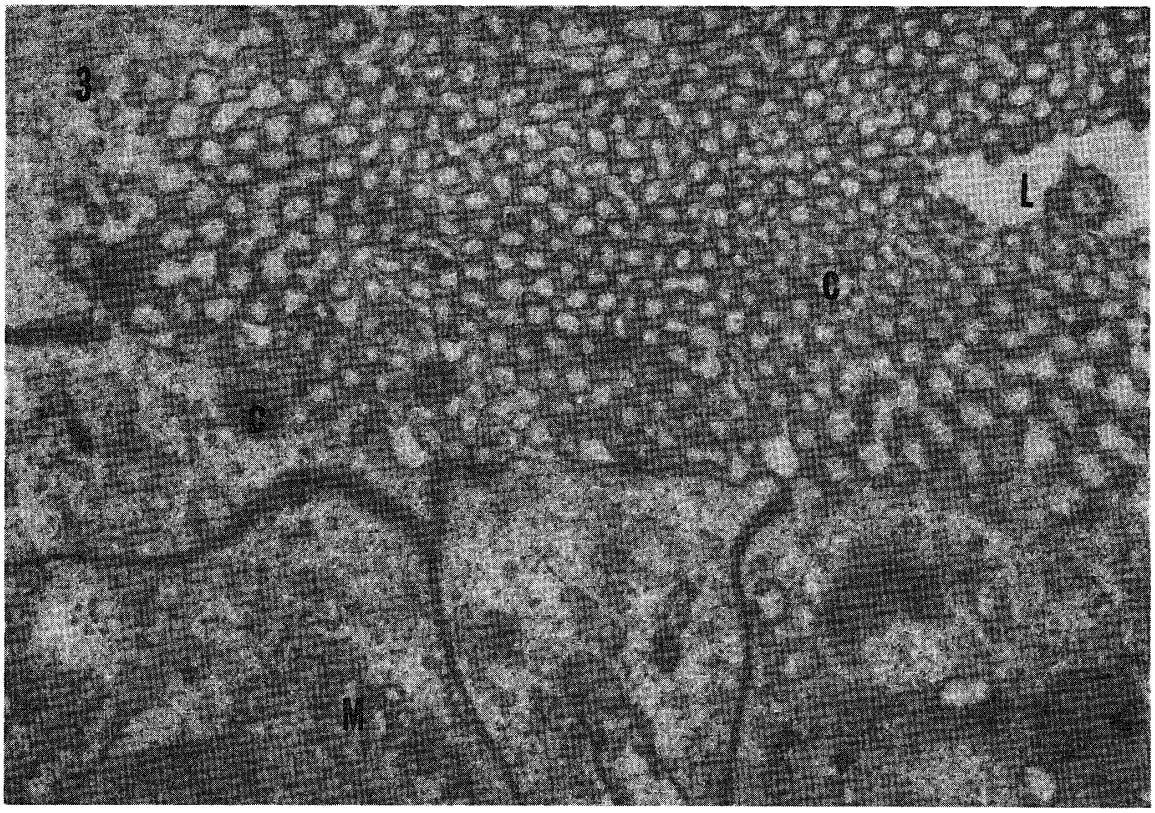
Explanation of Figures

FIG. 1. Oblique cross section through the distal part of the ciliated epithelial cells. A pair of central filaments is surrounded by nine pairs of filaments. Mitochondria are well-developed in the apical regions. M: Mitochondria ×9,000

FIG. 2. Oblique longitudinal section through the distal part of the light cells. Many microvilli are projected from the cell surface to the lumen of the tubules. L: Lumen, M: Mitochondria ×4,500


1
M


2
L
M


3
L
C
C
M

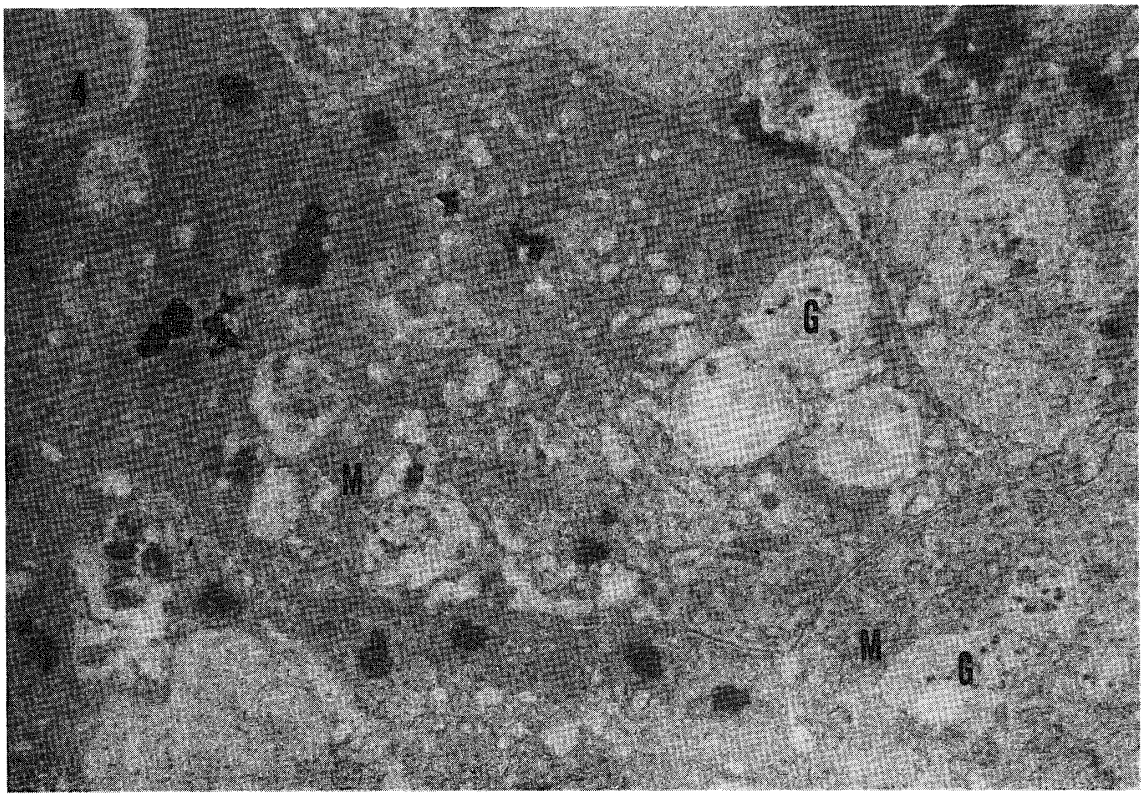

4
G
M
M
G

Plate 2

Explanation of Figures

FIG. 3. Oblique cross section through the distal part of the light cells. Microvilli are represented as a beautiful network and a few cilia are recognized in it. C: Cilium, L: Lumen, M: Mitochondria ×15,000

FIG. 4. Cross section through the supranuclear region of the light cells. Many granules are always surrounded with a thin membrane and their contents are light in electron density. G: Granules, M: Mitochondria ×6,000