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THE SECRETORY GRANULE AND THE LYSOSOME IN THE EPITHELIUM OF THE SEMINAL VESICLE

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INTRODUCTION

It is the purpose of this paper to point out the differences between the secretory granules and the lysosome-like granules occurring in the epithelium of the naked mouse seminal vesicle. In spite of an extensive literature servey, sufficient information of the difference between them could not be obtained. A few studies have been done since Fellinger and Pakesch[1] reported about electron microscopic investigations of the seminal vesicle. In recent papers, Deane, H. W., Wurzelmann, S.,[2] Porter, K. R.,[3] Takemoto, K.[4] and Fujita, M.[5] reported about the fine structure of the epithelium of the seminal vesicle. However, they stated little about the difference between the secretory granules and the lysosome-like granules. The purpose of this paper is to investigate electron microscopically the difference in more detail.

MATERIALS AND METHODS

Male naked mice, born in our own laboratory, were killed on days 225 and 282 after birth. All animals were killed between 10 and 12 A. M. The seminal vesicle was cut into smaller blocks while immersed in fixative. The specimens were fixed for one hour in phosphate buffered 1.25 % glutaraldehyde solution at pH 7.3. Subsequently the specimens were fixed in phosphate buffered 1 % osmium tetroxide, passed through graded alcohols, propylene oxide, and embedded in Epon 812. The specimen was cut on an LKB ultramicrotome with glass knives. All sections were stained with an alcoholic solution of uranyl acetate and aqueous lead citrate. The sections were examined in electron microscopes.

OBSERVATIONS

The wall of the seminal vesicles in the naked mouse consists of an external connective tissue sheet, a middle layer of smooth muscle, and a mucous membrane. The apical surface of the cell usually appears ruffled, occasional cells possess microvilli. The epithelium of the mucous membrane consists of a layer of round basal cells and a layer of larger, superficial, cuboidal or low columner cells (Fig. 1, 5). In electron observations, the most conspicuous characteristics of secretory epithelium of the seminal vesicle in the naked adult mouse is the abundance of ergastoplasm bounded by delicate membranes richly studded with ribosomes. The endoplasmic reticulum with associated

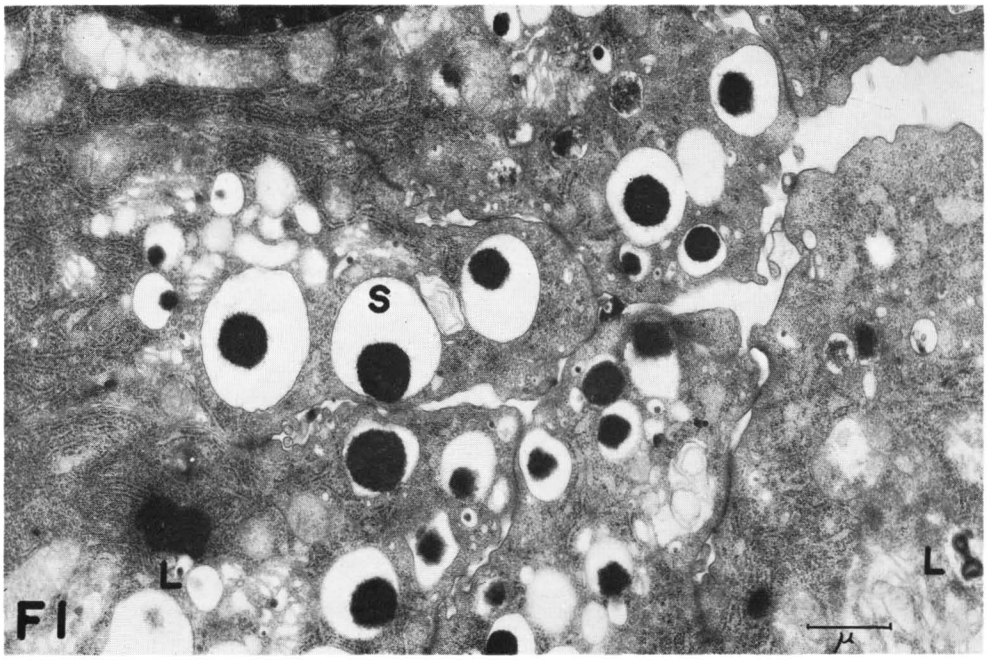

Fig. 1

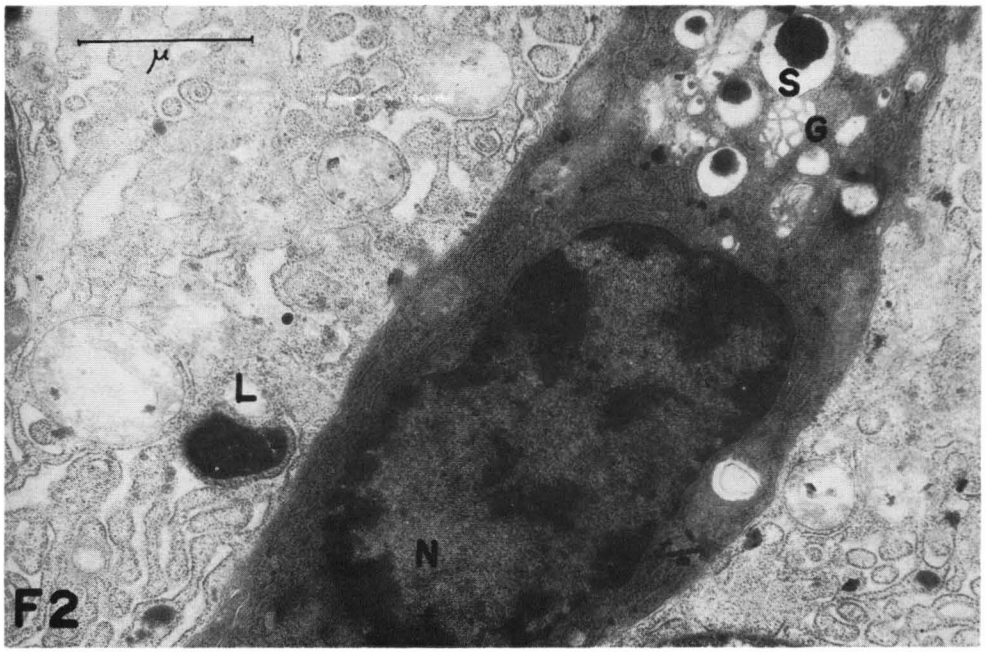

Fig. 2

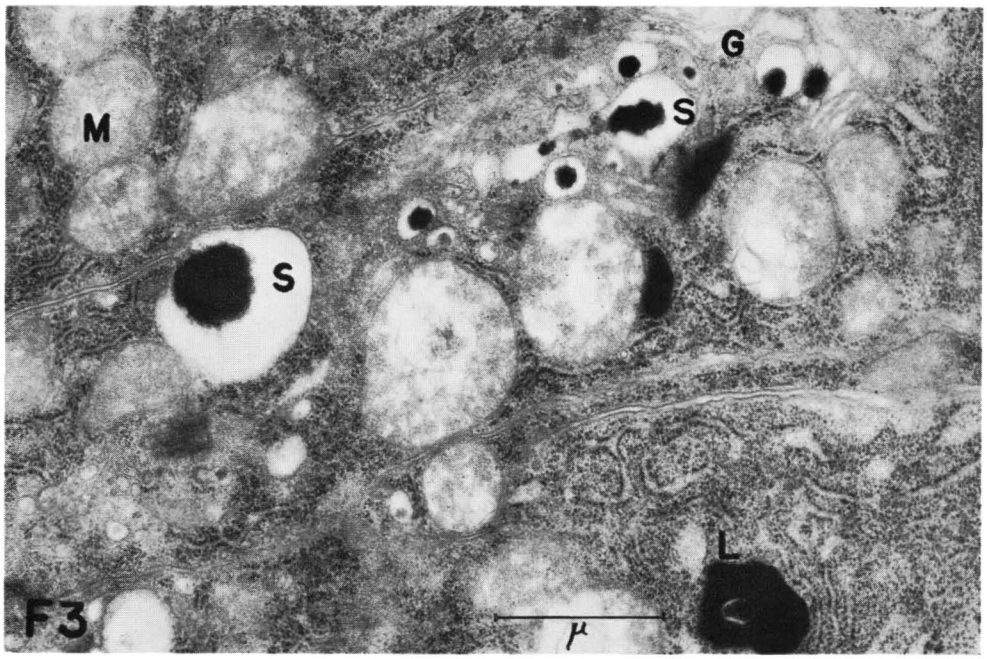

Fig. 3

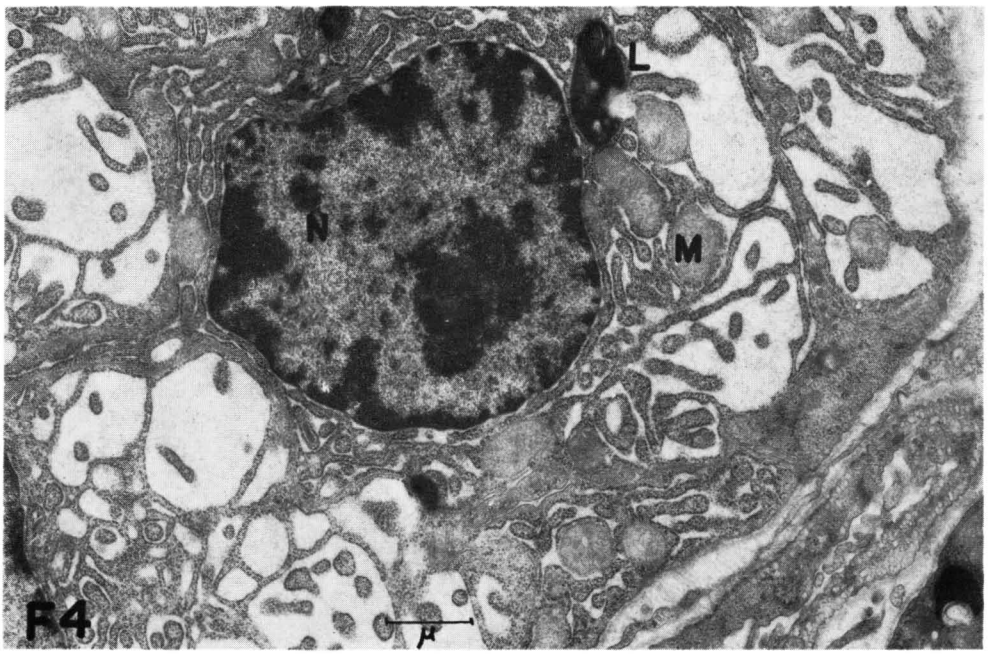

Fig. 4

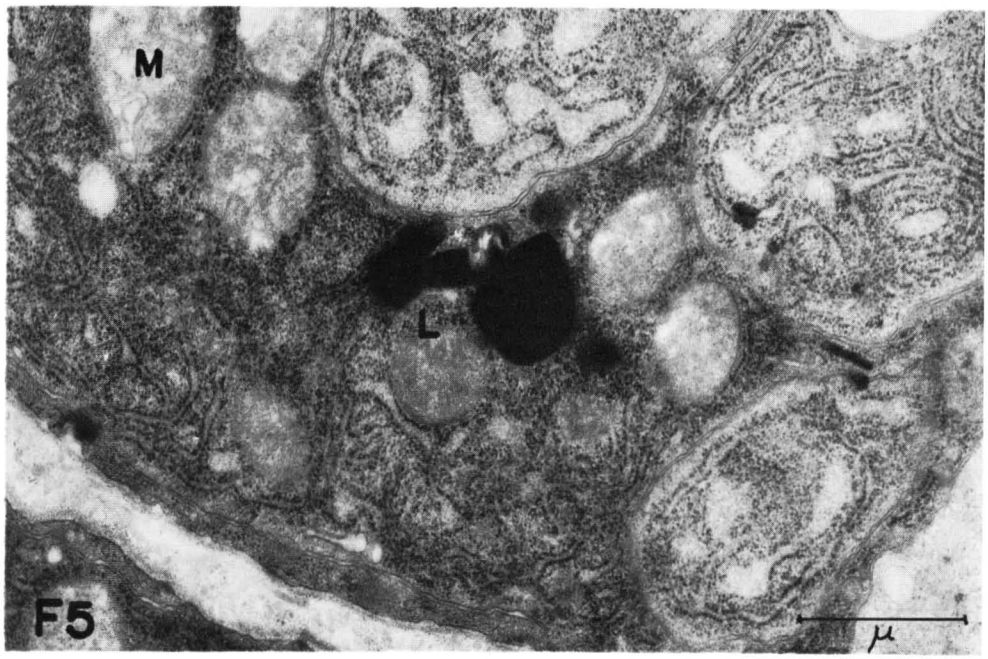

Fig. 5

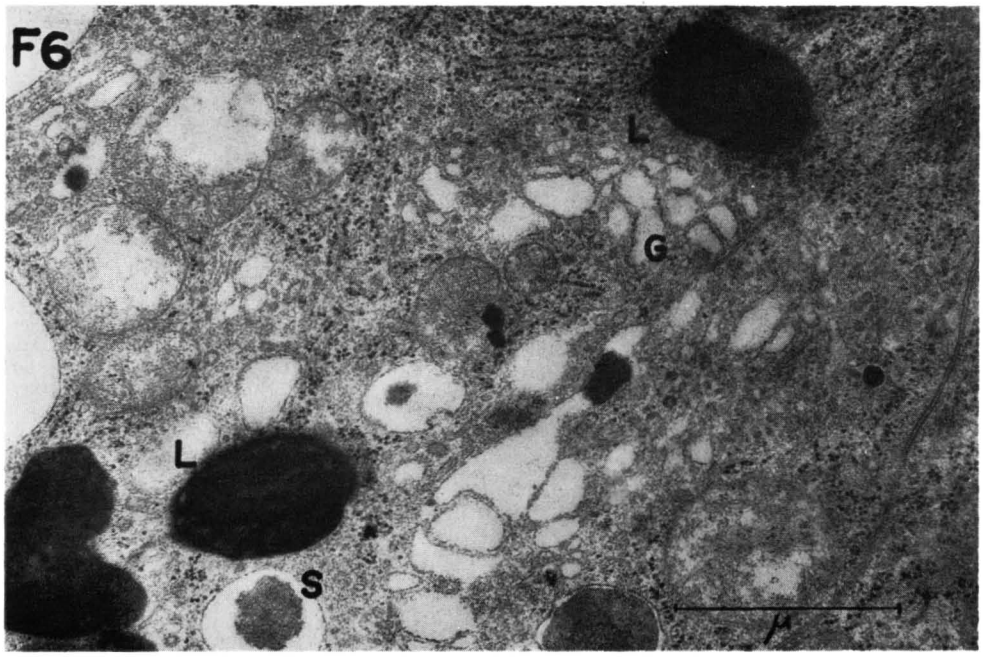

Fig. 6

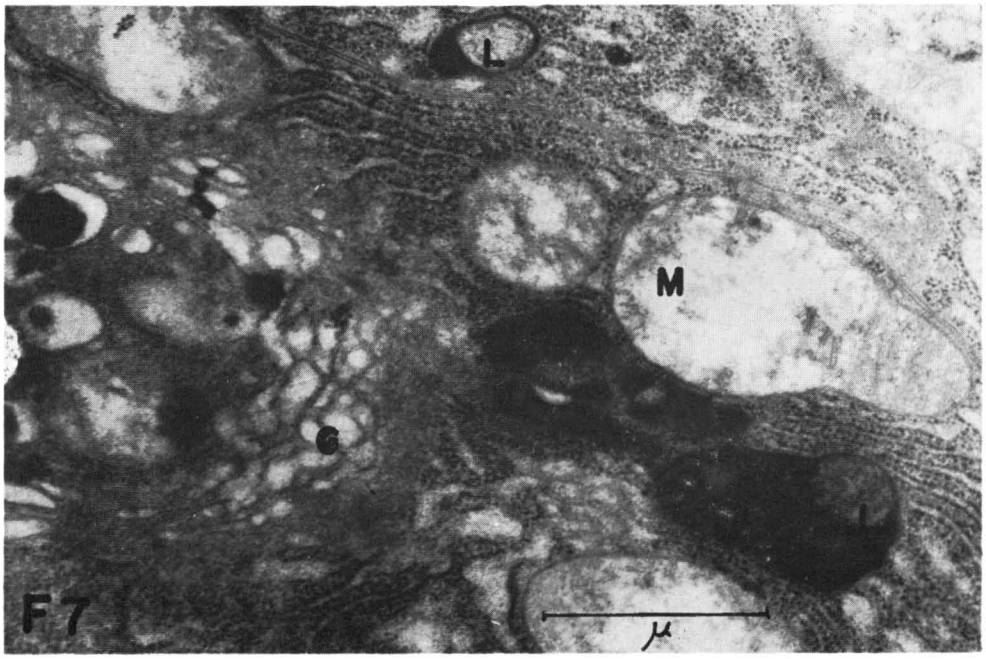

Fig. 7

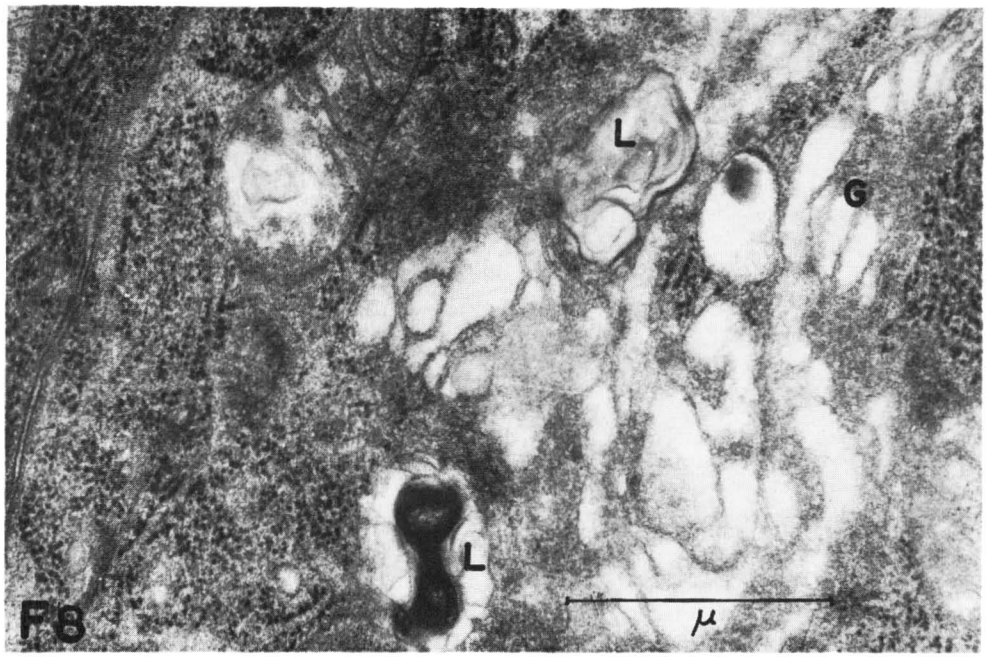

Fig. 8

ribosomes (ergastoplasm) appear moderately distended in the micrographs, and there is little detectable material preserved within them. In the supranuclear region, there are vacuoles or large vesicles bounded by single dense membranes, which appear thicker and more stable in preservation than those of the endoplasmic reticulum. The epithelial cells, especially in the deeper crypts between the folds, contain electron dense granules. The granules are divided into two classes, that is, a secretory granule and a lysosome-like granule (Fig. 1, 2).

Within the superficial portion of the cell body, the large vacuole-like structures which contain the dense secretory granules are recognized (Fig. 1). These vesicles or vacuoles, assumed to belong to Golgi apparatus, contain single dense or less dense secretory granules. The Golgi apparatus was observed at the supra-nuclear region and contained small dense granules which seemed to be precursor of the secretory granules (Fig. 2, 3). Ovoid less dense mitochondria with moderately complex internal structure are seen between the endoplasmic reticulum with associated ribosomes and among the Golgi vesicles.

Cytosomes are the most common type of lysosomes in the seminal vesicle epithelium of the naked mouse (Fig. 5, 8). They are single membrane limited bodies. They appear in the Golgi zone of the seminal vesicle epithelium of 225, 282-day-old naked mouse (Fig. 7, 8). The frequency of the appearance of the lysosome is relatively low, and have various size, shapes and contents (Fig. 4, 5, 7, 8). Fig. 6 shows a sample of lysosomes which are surrounded by a single limiting membrane, almost round in shape and heterogeneous in opacity. The shape is usually round and the size ranges approximately from 200 to 2,000 mμ in diameter. Some show irregular forms which may suggest aggregation of small round bodies (Fig. 5, 7). The contents are usually heterogeneous, sometimes forming dense cores or ring shapes or whorls of myelinated figures (Fig. 8). Observation by higher magnification reveal their close relation to Golgi apparatus (Fig. 7, 8).

DISCUSSION

It is difficult to point out morphologically the difference between the secretory granules and the lysosomes. In spite of an extensive literature survey, sufficient information on the differences between them could not be obtained. According to Fig. 1 and 2, secretory granules at various developmental stages can be visible in the Golgi complex and in the apical cytoplasm. The secretory material is packed in single limited membrane. The secretory material was coagulated by fixation. Therefore, clear space is observed between the secretory material and the limited membrane. Based on these facts, the seminal vesicle is a secretory organ.

On the other hand, the existence of lysosomes in rat liver cells was first found by biochemical fractionation of liver homogenates as a sediment between the microsome and mitochondria, containing lytic enzymes working mainly at acid pH. From their physicochemical properties these lysosomes were calculated to range in size between 0.25 and 0.8 μ. Lysosomes were defined, therefore, as membrane-limited particles containing acid

hydrolases. In the cytoplasm of the cell, some lysosomes have a smooth spherical or ovoid shape and a dense homogeneous interior. Others are quite irregular in outline and inhomogeneous in density; still others are large globular structures with a rather pale matrix. Acid phosphatase activity has been demonstrated histochemically in the seminal vesicle epithelium of the Zebu bull (Rollison[6], 1954) and the deer (Wislocki[7], 1949), while rabbit seminal vesicle tissue extract shows acid phosphatase activity (Bern[8], 1949). The existence of cytosome in the epithelium of the seminal vesicle of rabbit was first found by Takemoto (1961)[4] using the electron microscope. Cytosomes are the most common type of lysosomes. Single membrane-limited electron dense bodies are seen in the seminal vesicle epithelium of the naked mouse. These bodies are the lysosomes. Usually the number of the secretory granules in a cylindrical cell are more numerous than those of the lysosomes. Further differences are found in details of the bodies, that is, the lysosomes are sometimes larger in size than the secretory granules and on the other hand the shape is more irregular. The lysosome contains various kinds of cytoplasmic components, such as mitochondria, endoplasmic reticula and ribosomes.

CONCLUSION

The epithelium of the seminal vesicle of the naked mouse was observed electron microscopically and the following results were obtained:

1. In the cylindrical cell Golgi apparatus showed an ordinary development, and the cell body was occupied by the ergastoplasm, chiefly consisting of lamellar components.
2. Within the superficial portion of the cell body, the large vacuole-like structures which contained the dense secretory granules were observed.
3. The Golgi apparatus contained small dense granules which seemed to be precursors of secretory granules.
4. The secretory material was packed in single limited membrane and was coagulated by fixation. Therefore, clear space was observed between the material and limited membrane.
5. Based on these facts, the seminal visicle was concluded as a secretory organ.
6. In the cytoplasm recognized were lysosomes which showed various shapes, size and internal structures and seemed to have something to do with the phagocytosis of the cell.
7. The lysosome contains various kinds of cytoplasmic components, such as mitochondria, endoplasmic reticula and ribosomes.

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Explanation of Figures

Fig. 1. Electron micrograph of the apical portions of several columnar cells from the seminal vesicle of a naked mouse. The apical membrane exhibits some microvilli.

Fig. 2. A dark cell can be seen in the middle of the field. Several vacuoles with a secretory material, compact stacks of Golgi saccules and associated small vesicles are seen in the supranuclear region of the dark epithelial cell.

Fig. 3. Electron micrograph of a section through the basal portions of the seminal vesicle epithelium of a 282-day-old mouse.

Fig. 4. The basal portion of the epithelial cell plus some of the underlying tissue. The basal cell contains a large nucleus, scattered mitochondria, ergastoplasm, and a few dense body.

Fig. 5. The basal portion of a basal cell. The dense body in the middle of this field may be a lysosome. Mitochondria and ergastoplasm are seen around the lysosomes.

Fig. 6. The Golgi zone of one cell is mostly composed of distended saccules. Several electron dense bodies which are seemed to be lysosomes are seen along the zone.

Fig. 7. Small secretory granules occur within Golgi vacuoles. Several electron dense lysosomes are seen at right half field. Mitochondria-like materials are involved in the lysosomes.

Fig. 8. One secretory granule and two lysosomes are included in some distended Golgi vacuoles. Dense cores of ring shapes or whorls of myelinated figures which are considered as a residual body are seen in the lysosomes.

Abbreviations

F: figure, G: Golgi apparatus, L: lysosome, M: mitochondria, N: nucleus,
S: secretory granule, ⊢——⊣: scale: 1 μ

(和文抄録)

精嚢上皮細胞の分泌顆粒とライソゾーム

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武　藤　　浩

無毛ハツカネズミ naked の精嚢上皮を電子顕微鏡的に観察し，つぎの結果を得た．

1. 円柱上皮細胞では Golgi 装置は通常の発達を示し，細胞体は ergastoplasm で占められ，おもに層板成分からなる．

2. 細胞体の上部には，電子密度大なる分泌顆粒をいれた大きい空胞状構造が観察される．

3. Golgi 装置には分泌顆粒の前駆と思われる電子密度大なる小顆粒を認めた．

4. 分泌物質は一重の限界膜で包まれ，固定により凝結する．それゆえに分泌物質と限界膜との間には，明るい空隙が観察される．

5. このような事実から精嚢は分泌器官と結論された．

6. 細胞質には種々の形，大きさ，内部構造を示すライソゾームが認められ，細胞の食作用と関係があるようである．

7. ライソゾームは種々の細胞内成分，例えばミトコンドリア，小胞体，リボゾームなどを含んでいる．