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LYMPHOCYTES OF CANINE PERIPHERAL BLOOD IN ELECTRON MICROSCOPY

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The fine structure of the lymphocytes in the peripheral blood of clinically normal dogs was observed by the use of an electron microscope. The results thus obtained were summarized as follows.

1) The fine structure of the canine lymphocytes was fundamentally similar to that of the human lymphocytes.

2) The maculous appearance of the nucleoplasm was less marked than that of the canine neutrophils.

3) A nuclear body was observed in the nuclei of some lymphocytes.

4) An area consisting of fine dust-like particles and without any microorganelles was observed in the cytoplasm of some lymphocytes.

5) The size of the mitochondria of the lymphocytes was larger than that of the canine monocytes.

6) Some of the dense granules in the cytoplasm seemed to have resulted from the accumulation of a dense mass in the mitochondria.

INTRODUCTION

In the previous papers¹¹⁻¹³⁾, the authors reported on the fine structures of the neutrophils, eosinophils and monocytes in the peripheral blood of clinically normal dogs.

In the present paper, the fine structure of lymphocytes in canine peripheral blood will be described.

MATERIALS AND METHODS

Blocks for electron microscopic observations and methods of the observations were just the same as those described in the previous papers¹¹⁻¹³⁾.

OBSERVATIONS

General figure of the lymphocytes was round or oval; however, the outline of the cells was slightly irregular with many sharp and blunt pseudopodic projections.

Nucleus

The nucleus occupied the greater part of the cell. They were generally round or oval and frequently had blunt indentations or deep incisions, therefore, they looked irregular in

form. Chromatin was formed from small condensations throughout the entire nucleus or, more often, from slightly larger clumps adhering to the nuclear surface. However, the maculous appearance was not so marked. There was almost always a nucleolus present, or at least the remains of one, surrounded by chromatin.

In the nucleus of some cells, there was a so-called nuclear body of variable size. They were round in form and consisted of two layers, inner and outer. The inner layer corresponded to the core of the body and had a granular structure consisting of very dense granular particles. On the other hand, the outer layer of the body showed a narrow, less dense filamentous structure encircling the core.

Cytoplasm

The cytoplasm of the cell was lineated by a fine membrane. This showed narrow bands around the nuclei. There were a lot of ribosomes distributed in the cytoplasm. They were sometimes aggregated and formed so-called polysomes.

There were a few or several mitochondria. They had generally a tendency to be located collectively in a part near the Golgi complex. The shape of the mitochondria was round, oval or short rod-like and they had clear cristae in them. The sizes of the round and elongated ones were 0.56 ($0.48\sim 0.64$) μ and 0.55 ($0.40\sim 0.80$) by 0.88 ($0.56\sim 1.16$) μ , respectively. In the cytoplasm of the cells, poorly developed Golgi complexes consisting of small vesicles were seen. There was a small quantity of endoplasmic reticulum which was mainly smooth-surfaced one in a small round form, while rough-surfaced endoplasmic reticulum was present, too. They were small canalicular in form and few in number. Sometimes, one or two dense granules were found in the cytoplasm. Their size and structure were very variable. Namely, their size was $0.29\sim 0.38$ by $0.43\sim 0.75$ μ in the present observations. They were lineated clear unit membranes. The matrix of the granules consisted of a considerably dense fine substance. Inside of them, various large more dense masses were observed. Furthermore, in the matrix, sometimes, a few membranous substances like a unit membrane were seen.

In the part near the Golgi complex of the cytoplasm, there was an area which looked gray, because of the presence of fine dust-like particles compactly distributed in particular. In this area, microorganelles were never seen. A few small vacuoles were present in the cytoplasm.

CONSIDERATIONS

The fine structure of the lymphocytes in the human peripheral blood was observed by many investigators^{1,2,4~8,15,17} through the electron microscope. On the basis of these observations, slight condensation of the chromatin granules, scanty microorganelles, a reduced Golgi complex, little-developed endoplasmic reticulum consisted of small vesicles and sometimes the presence of a few dense granules in the cytoplasm seemed to be the characteristics of the fine structures of the cells.

In the present observations of the canine lymphocytes, similar findings as those described above were observed, too. However, in our observations, in

addition, nuclear bodies were observed in the nuclei of some lymphocytes. The structure of the body was the same as those of various parenchymatous and intestinal cells of the calf by WEBER & FROMMES and of lymphocytes of mouse lymph nodes observed by SUGIMURA et al. Furthermore, in the cytoplasm of some lymphocytes, there was an area consisting of fine dust-like particles and in which microorganelles were never present. As far as the authors know, nobody has pointed out such an area in the cytoplasm of the lymphocytes in normal human blood. At the present time, the authors don't know what it is.

LOW & FREEMAN observed two kinds of dense granules in the cytoplasm of human peripheral lymphocytes; one was about 0.5 by 0.3 μ , roughly the same size as the mitochondria, the other consisted of unidentified granules about 0.1 to 0.2 μ in diameter. The former one was very or moderately dense and contained an oval lucid area or an oval inclusion of high density, and sometimes it was made up of dense, closely packed laminae.

BESSIS & THIERY reported that in the cytoplasm of the lymphocytes in the lymph nodes, there were two kinds of granules, the Gall body which was rounded and not very dense and dense granules surrounded by a fine osmiophilic membrane seemed to correspond to azurophilic grains. In the present observations, dense granules of various sizes and structures were observed, too. Some of these granules were lined by a clear unit membrane, and had a membranous substance like the unit membrane in the matrix. Furthermore, their size was roughly similar to that of mitochondria. From these findings, it may be thought that some of the dense granules derived from the accumulation of dense materials in the mitochondria.

Compared with those of the monocytes already reported by the authors¹³, it was clear that the size of the mitochondria of the canine lymphocytes was larger than that of the monocytes.

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EXPLANATION OF PLATES

PLATE I

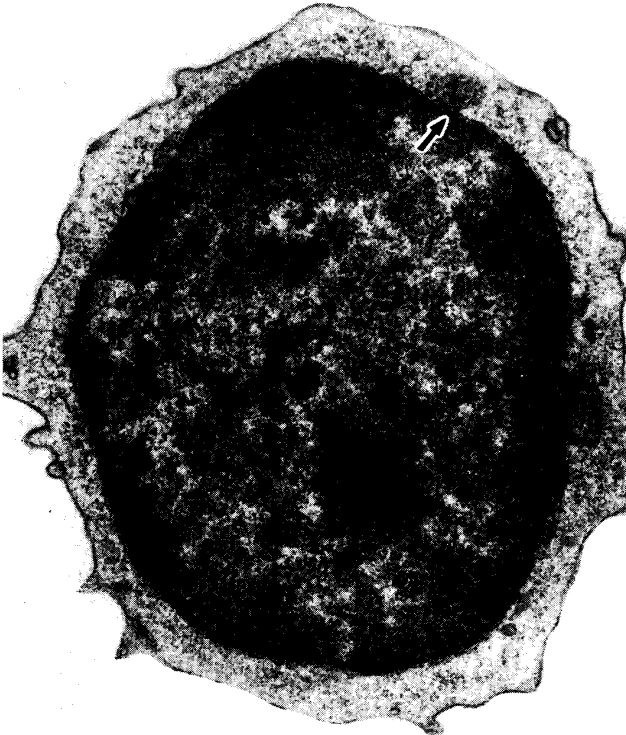
General figures of 4 lymphocytes are shown.

Figs. 1 & 2 The cells in figures 1 and 2 have a slightly maculous appearance in the nuclei and scanty cytoplasm. A nucleolus is clearly seen in the nucleus in figure 2. Several small vesicles are gathered in the parts of the cytoplasm (arrows). It may be a poorly developed Golgi complex. $\times 12,500$

Fig. 3 A nucleolus is clearly seen in the nucleus. There is an area consisting of dust-like particles (AD) in a part of the cytoplasm. In this area, no microorganelles are present. Near the area, two mitochondria are seen. $\times 11,500$

Fig. 4 An ill-developed Golgi complex consisting of small vesicles (G) is seen in a part of the cytoplasm. A clear longitudinal mitochondrion is present in the upper part of the cell. $\times 13,500$

1



2



3



4

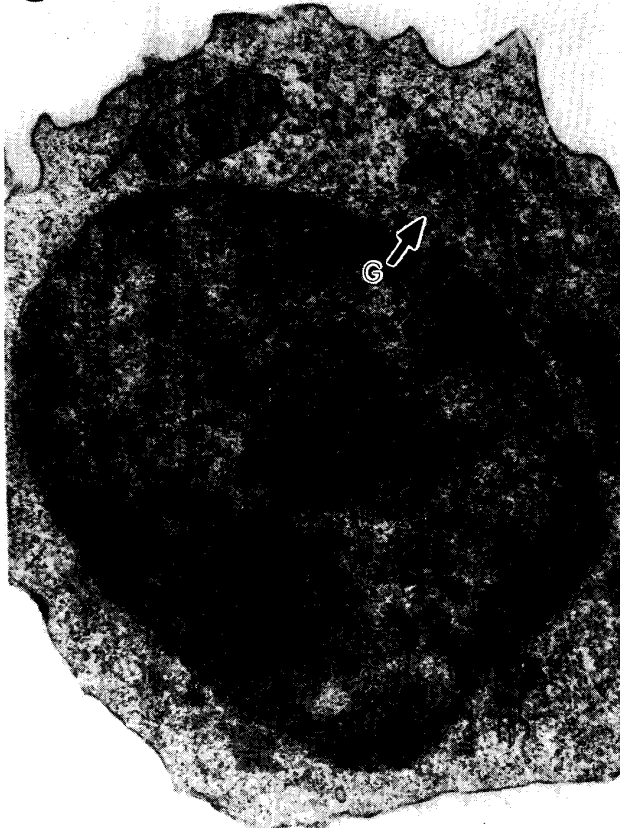


PLATE II

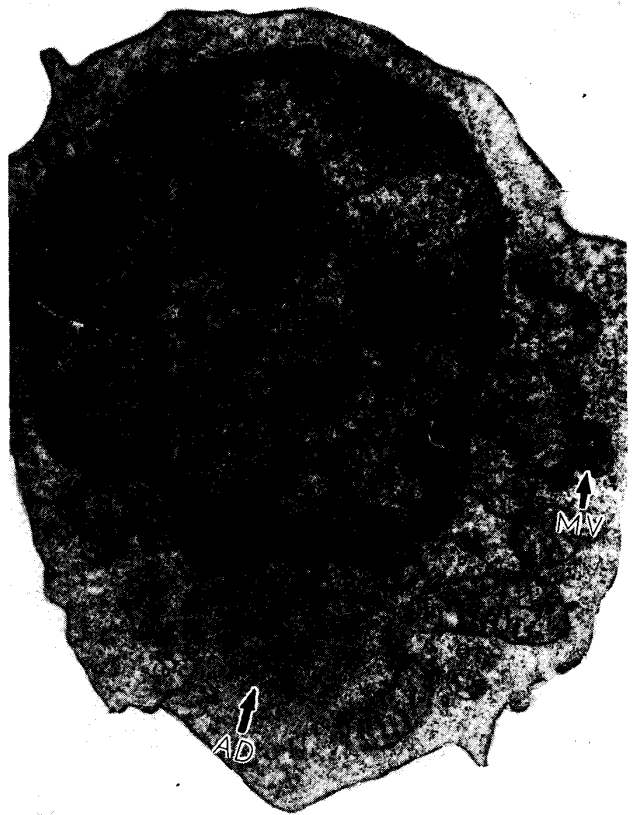
General figures of lymphocytes are shown.

- Fig. 5 The nucleus is irregular in form. A nucleolus is present in the nucleus. Five mitochondria are distributed around the nucleus sparsely in the cytoplasm. There is a multivesicular body (MV) in the Golgi area. $\times 12,500$
- Fig. 6 Several mitochondria are seen collectively in an area of the cytoplasm. At the lower part of the cell, AD is clear. A multivesicular body (MV) is present. $\times 12,500$
- Fig. 7 A nucleolus and a small nuclear body (NB) are present in the nucleus. In the cytoplasm, AD is present. $\times 12,500$
- Fig. 8 The nucleolus is round and the cytoplasm is scanty in appearance. $\times 12,500$

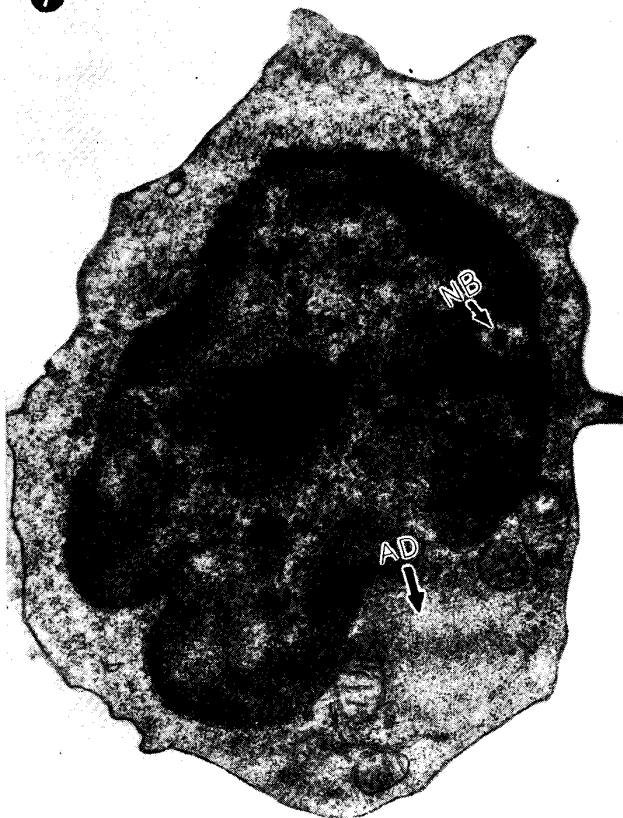
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6



7



8

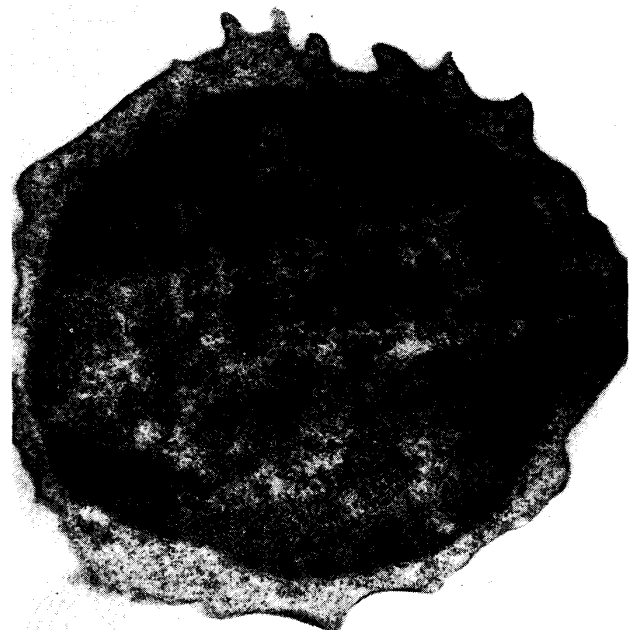


PLATE III

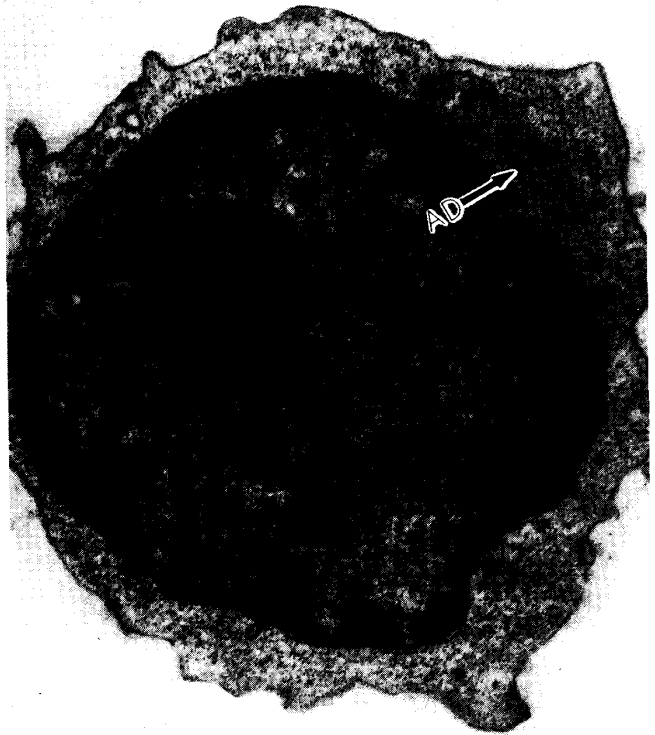
General figures of lymphocytes are shown.

- Fig. 9 The nucleus is oval and the maculous appearance is not so clear. It has a nucleolus in the nucleoplasm. In the cytoplasm, there are many small round vesicles and a few vacuoles. A lot of ribosomes are distributed all over the cytoplasm. $\times 12,500$
- Fig. 10 A nucleolus is evident in the nucleus. AD is present in the right upper area of the cell. $\times 12,500$
- Fig. 11 An ill-developed Golgi complex is seen. $\times 16,500$
- Fig. 12 Several mitochondria are present collectively in the upper area of the cell. Among them, a few number of rough-surfaced endoplasmic reticulum (rE) are seen. $\times 12,500$

9



10



11



12

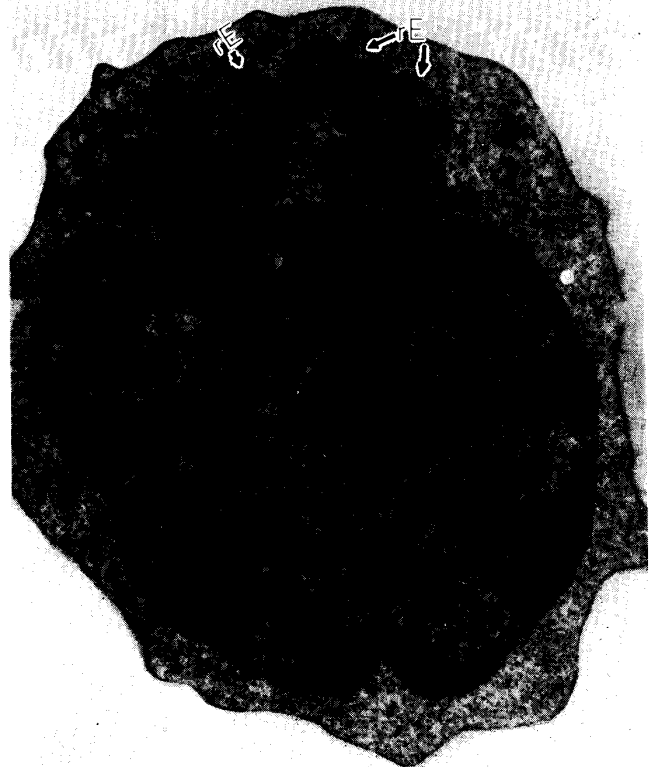
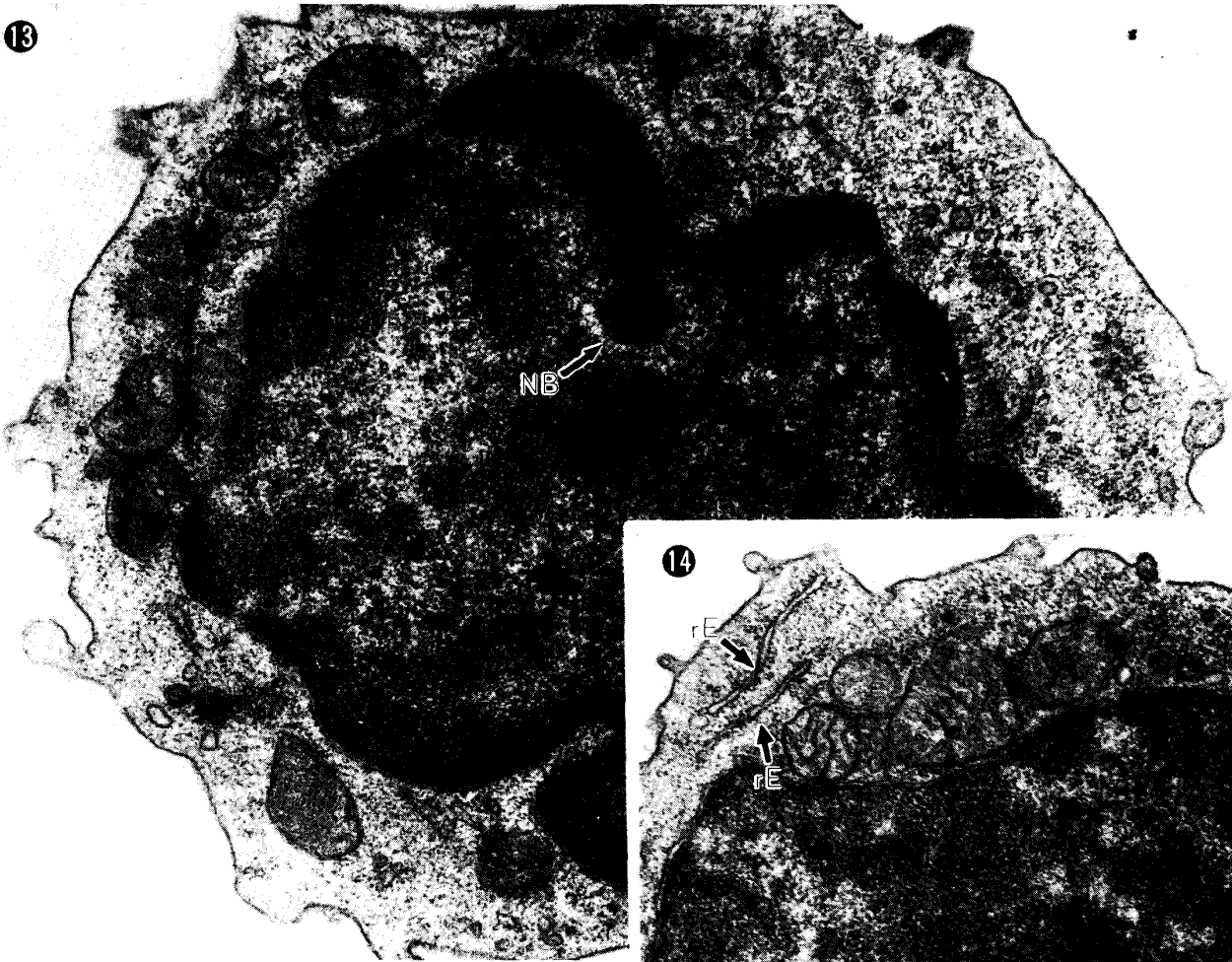


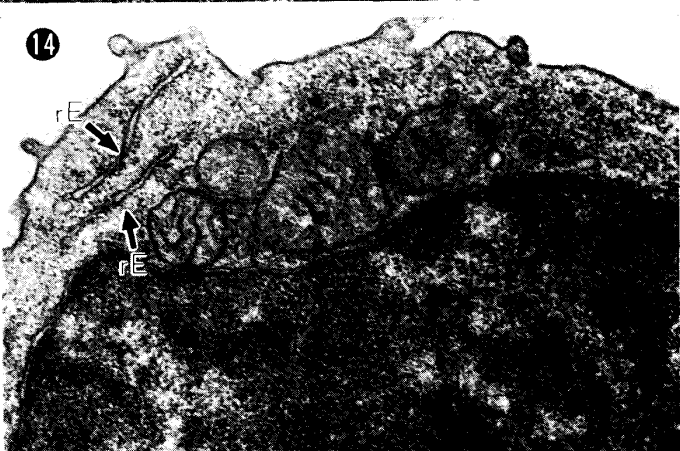
PLATE IV

- Fig. 13 A clear nuclear body (NB) is seen in the nucleus. There are a lot of ribosomes in the cytoplasm. $\times 20,000$
- Fig. 14 Two rough-surfaced endoplasmic reticulum (rE) are evident. $\times 20,000$
- Fig. 15 The enlargement of the nuclear body in figure 13 is shown. The inner layer (core) consists of a lot of dense granules and the outer layer of a filamentous structure encircling the core. $\times 70,000$
- Figs. 16~18 These are the dense bodies observed in the cytoplasm. They have a considerably dense matrix linedated by unit membranes. In the matrix, there are from one, to a few, more dense masses. Unit membrane-like substances (arrows) are seen in the matrix of the dense bodies in figures 16 and 17. $\times 70,000$

13



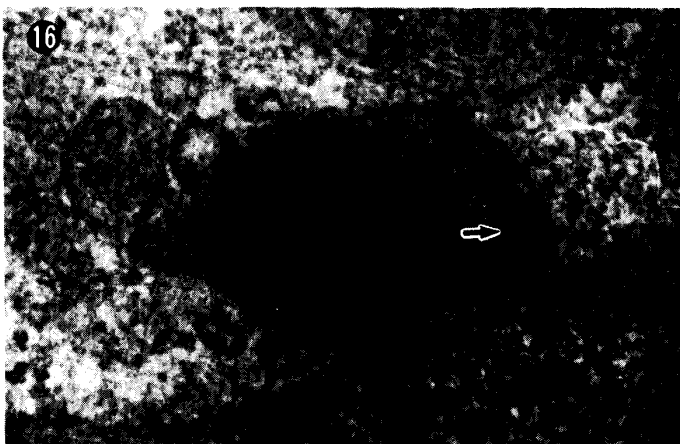
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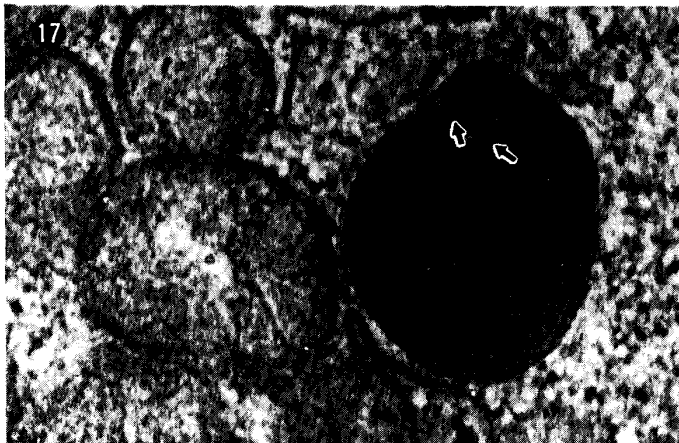
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16



17



18

