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MONOCYTES OF CANINE PERIPHERAL BLOOD IN ELECTRON MICROSCOPY

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The fine structures of monocytes in the peripheral blood obtained from 5 clinically normal dogs were observed in electron microscopy.

The results thus obtained were summarized as follows.

- 1) The fine structures of the monocytes were fundamentally identical to those of the human monocytes.
- 2) The characteristic of the canine monocytes was the presence of a few to several dense granules of variable sizes in the cytoplasm of all the cells.

INTRODUCTION

In the previous papers^{7,8)}, the authors reported on the fine structures of neutrophils and eosinophils in the peripheral blood of clinically normal dogs.

In the present paper, the results of the electron microscopic observations of the monocytes in canine peripheral blood will be described.

MATERIALS AND METHODS

The materials and methods used in this experiment were just the same as those of the previous papers⁶⁻⁸⁾.

OBSERVATIONS

The general form of the monocytes on the visual fields under the microscope was round or oval. The outline of the cells was markedly irregular with many large and small cytoplasmic projections. The size of this cell type was the generally largest among the cell types appearing on the visual fields, though they varied in size considerably on the cut planes.

Nucleus

The forms of the nuclei of the monocytes appearing on the visual fields were round, oval, rod-like or irregularly round. Almost all the nuclei had one lobe, but some showed 2~3 nuclear lobes in accordance with the cut directions on the cut planes. The nuclei were lined with clear nuclear membranes. In some parts of the nuclear membranes, the nuclear pores were evident. The interior of the nucleus consisted of fine granular particles distributed compactly or loosely. The peripheral parts of the nuclear membranes were usually dark and the central areas of the nucleoplasm were light, and they gave

a so-called maculous appearance. In some of the nuclear lobes, one or two small aggregations of fine particles with high electron density were observed.

Cytoplasm

The background of the cytoplasm was filled with very fine point-like particles and they were gray in appearance. Several mitochondria with clear cristae were distributed in the cytoplasm. Most of them were round but some were elongated like short rods in form. The size of the round ones was $0.25\sim 0.45\ \mu$ in diameter and they were $0.33\ \mu$ on the average. In the central areas of the cytoplasm, there were ill- to well-developed Golgi complexes consisting of a vesicular and lamellar structure. Near these areas, one or two centrioles were sometimes observed. In the cytoplasm, from a few to several evenly dense granules with very variable sizes were observed. Almost all of them were round but some were oval, rod-like or looked like grains of rice in form. They were lined by a clear membrane. In general, they were distributed in groups on the wide areas of the cytoplasm facing the concave parts of the nuclei, but some were anywhere in the cytoplasm. The sizes of the round and elongated ones were $0.1\sim 1.25\ \mu$ and $0.1\sim 0.3$ by $0.4\sim 1.55\ \mu$, respectively. A great amount of small round smooth-surfaced endoplasmic reticulum were distributed on all over the cytoplasm. In addition, quite a lot of rough-surfaced endoplasmic reticulum with the short canalicular form were observed, too. A lot of ribosomes distributed evenly in the cytoplasm were seen. Near the peripheral areas of the cytoplasm, many phagocytic vacuoles were present.

CONSIDERATIONS

It has been recognized that round, irregularly round, rod-like and horseshoe-like nuclei, well-developed smooth-surfaced endoplasmic reticulum, and a lot of mitochondria smaller than those of the lymphocytes are the characteristics of the fine structures of the human monocytes^{1,3,9}). These cell characteristics were observed in the canine monocytes, too. However, in the canine monocytes, in addition, the presence of a few to several dense granules with round, spherical, rod-like or rice grain-like form in very variable sizes was observed. Namely, the largest round and rod-like ones were $1.25\ \mu$ in diameter and 0.2 by $1.55\ \mu$ in size, respectively.

WATANABE reported the presence of a small number of granules similar to the type A granules of the neutrophils in human monocytes, however, they were much smaller and less dense than those of the canine monocytes observed by the present authors. FREEMAN & SHIVERY et al. reported on the fine structures of the canine monocytes, but they didn't show such variably large granules as the present authors.

In the micrographs of human blood presented by LOW & FREEMAN, it was shown that in general the monocytes didn't have any dense granules in their cytoplasm and only a few monocytes had quite exceptionally dense granules with varying large sizes in the cytoplasm.

In the present observations, dense granules were always present in the cytoplasm of the canine monocytes.

In the light microscopy, SCHALM described that there were two types of monocytes in the canine blood. The type I is characterized by having a rounded nucleus that fills the cell and usually has some nuclear foldings. The chromatin is lacy and stains fairly intensely, sometimes appearing almost granular. The cytoplasm is granular, takes a dark blue stain, and azurophilic granules are often present. Type II stains much more lightly, the nucleus has an irregular outline, sometimes being almost lobular in appearance.

From the present observations, it is clear that there is no fundamental difference among the canine monocytes, though there were slight differences in the minute structures of each of the monocytes.

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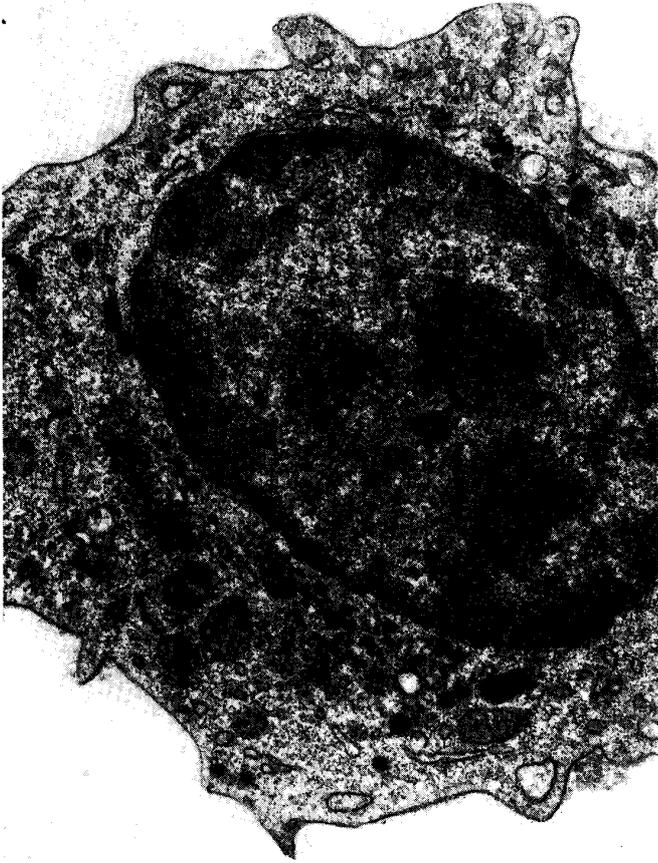
EXPLANATION OF PLATES

PLATE I

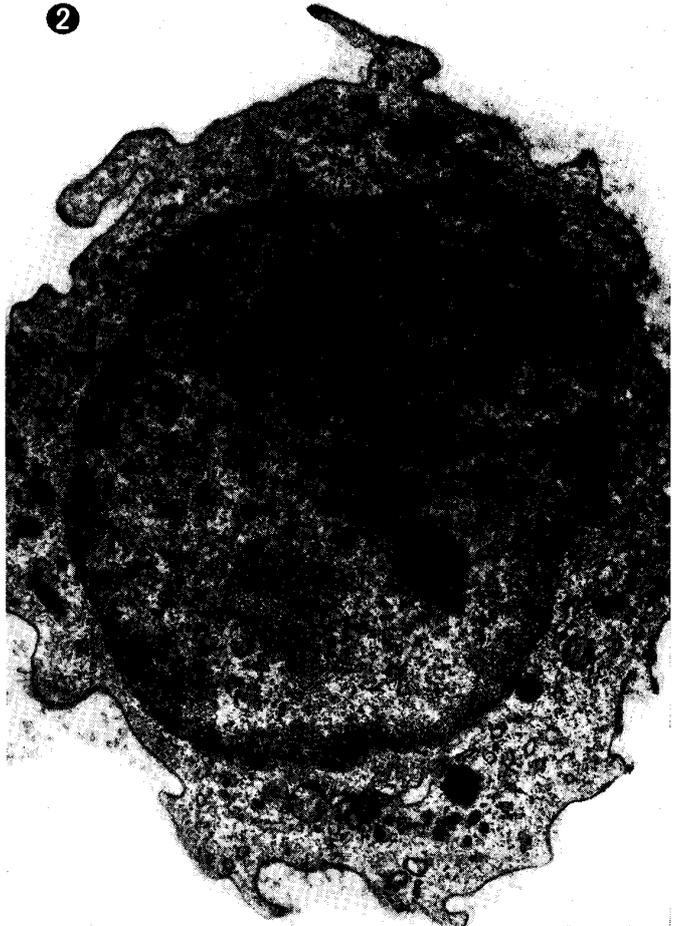
Figs. 1~4 Nuclei of the monocytes are slightly irregularly oval in figures 1 and 2 and binucleated in figures 3 and 4, respectively. The aggregations of dense particles are observed in the nuclei of all the monocytes. In the cytoplasm, there are abundant ribosomes. Moderate- or well-developed Golgi complexes are seen in figures 1, 3 and 4. Many large and small cytoplasmic projections are seen in the peripheral areas of the cytoplasm. Many smooth- and some rough-surfaced endoplasmic reticulum are present in all figures.

× 12,500

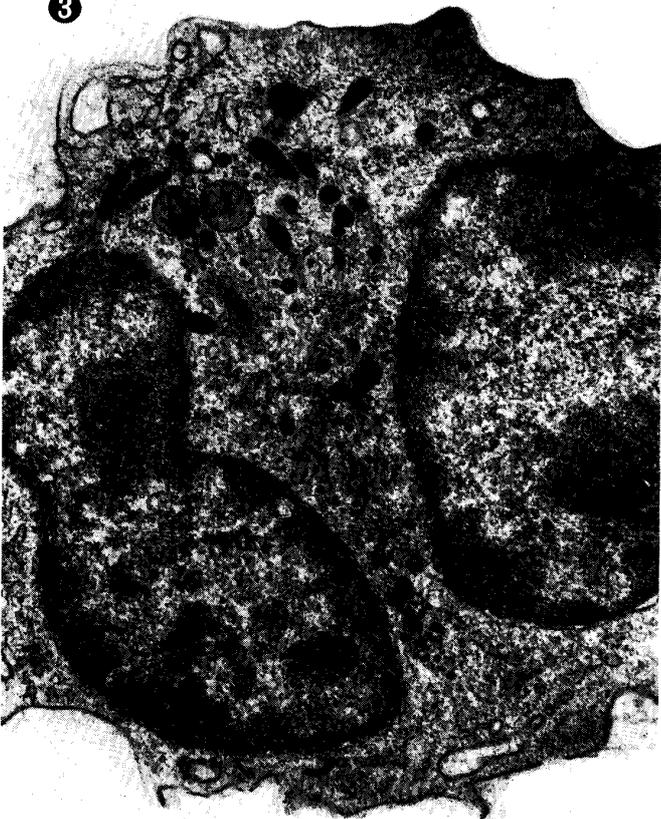
1



2



3



4

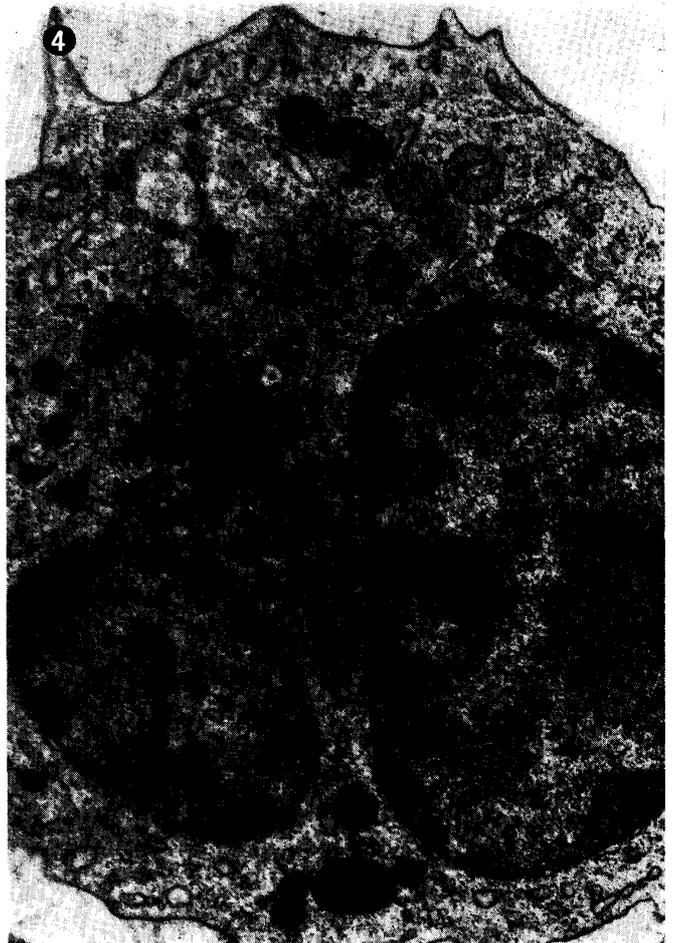
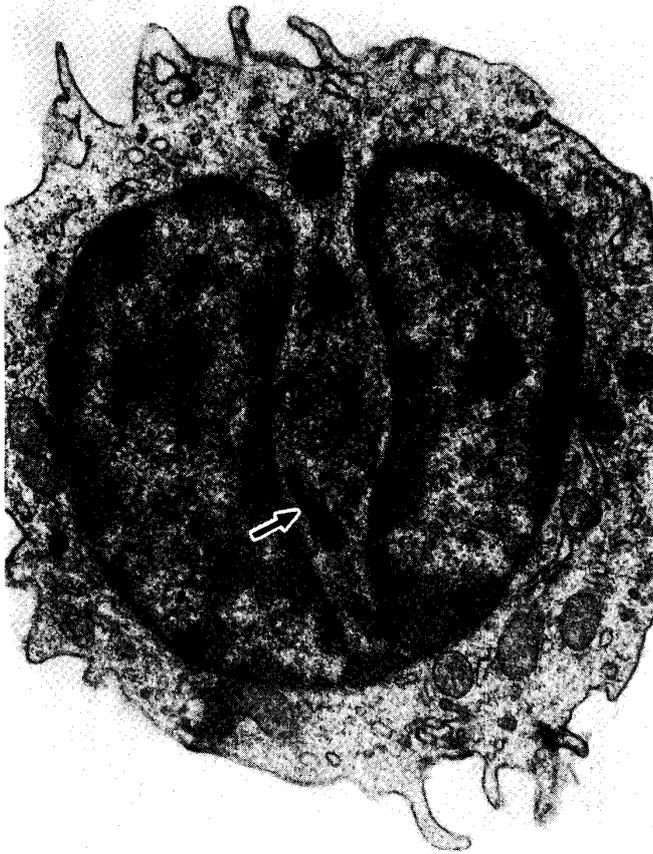


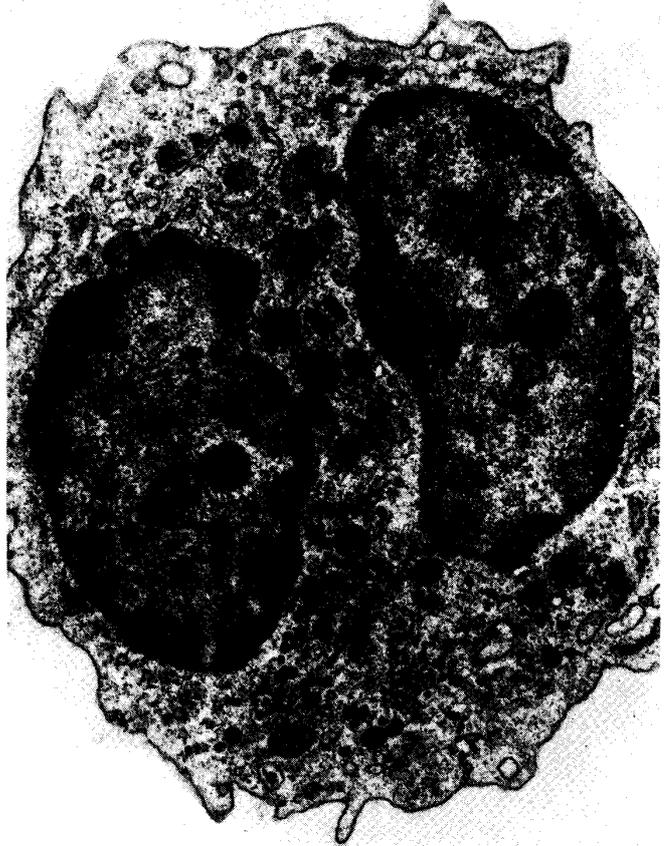
PLATE II

- Fig. 5 A horseshoe-like nucleus is seen. A rod-like dense granule (arrow) is present in the central area of the cytoplasm.
× 12,500
- Fig. 6 Bilobulated nuclei are seen.
In both nuclear lobes, aggregations of particles of high density are present.
× 12,5000
- Fig. 7 Several dense granules are present collectively in the upper part of the cytoplasm. A moderate-developed Golgi complex is seen in the lower part of the cell.
× 12,500
- Fig. 8 A well-developed Golgi complex is seen in the central area of the cytoplasm.
× 12,500

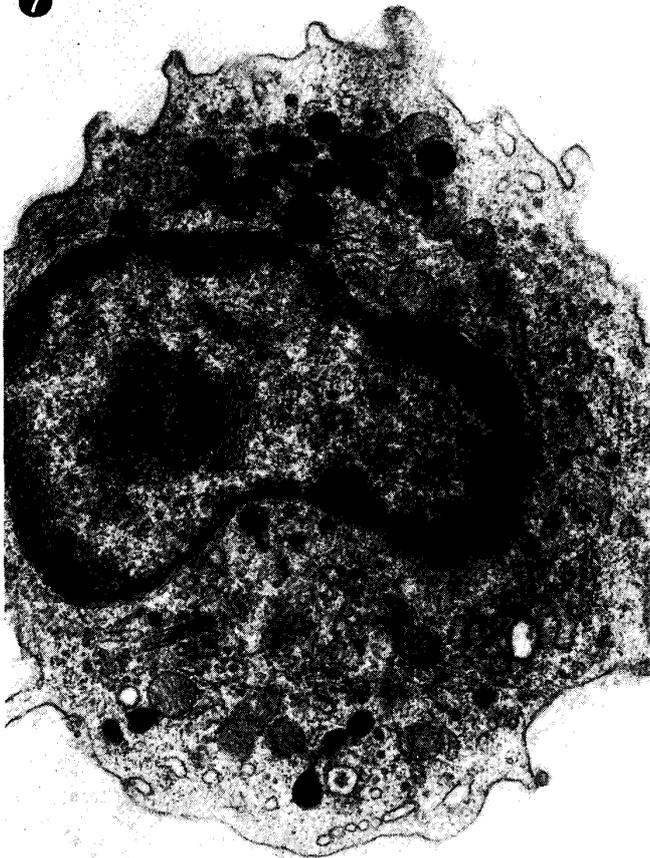
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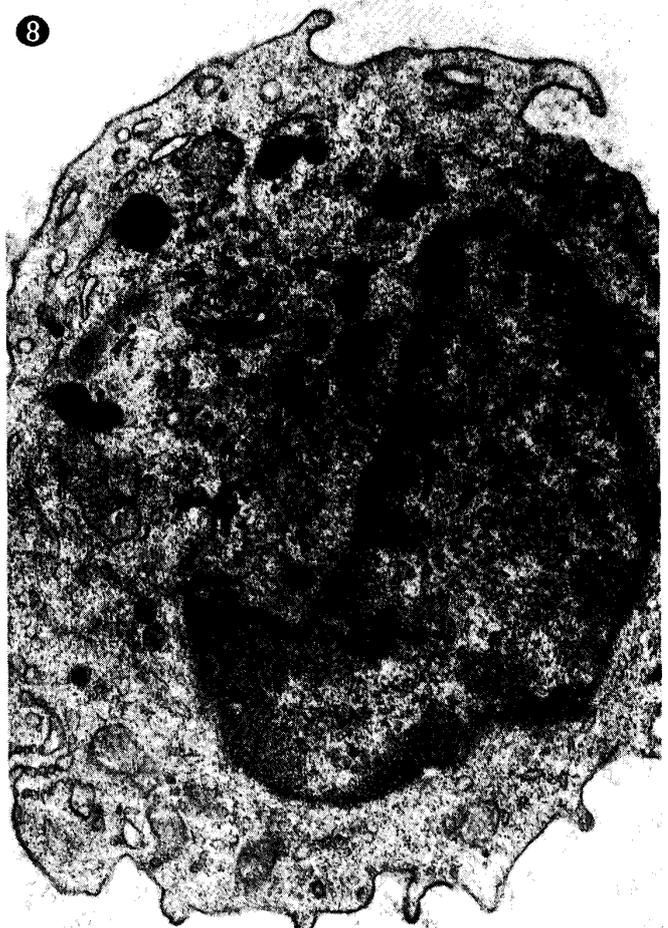


PLATE III

Figs. 9~12 In the cytoplasm of these cells, the dense granules with very variable sizes are seen. Especially, extra-large ones (arrows) are present in the cytoplasm in figures 9, 10 and 12.
× 12,500

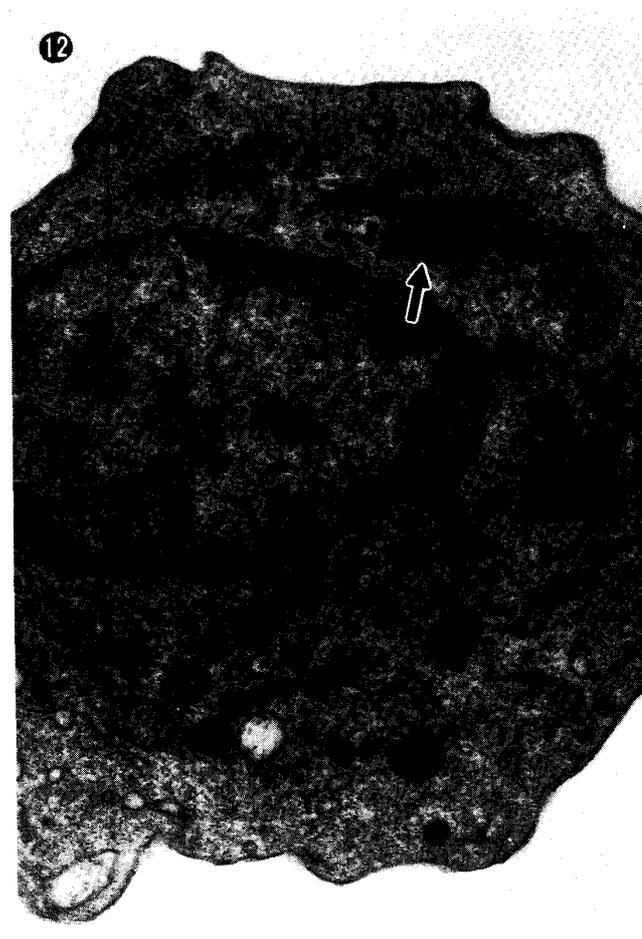
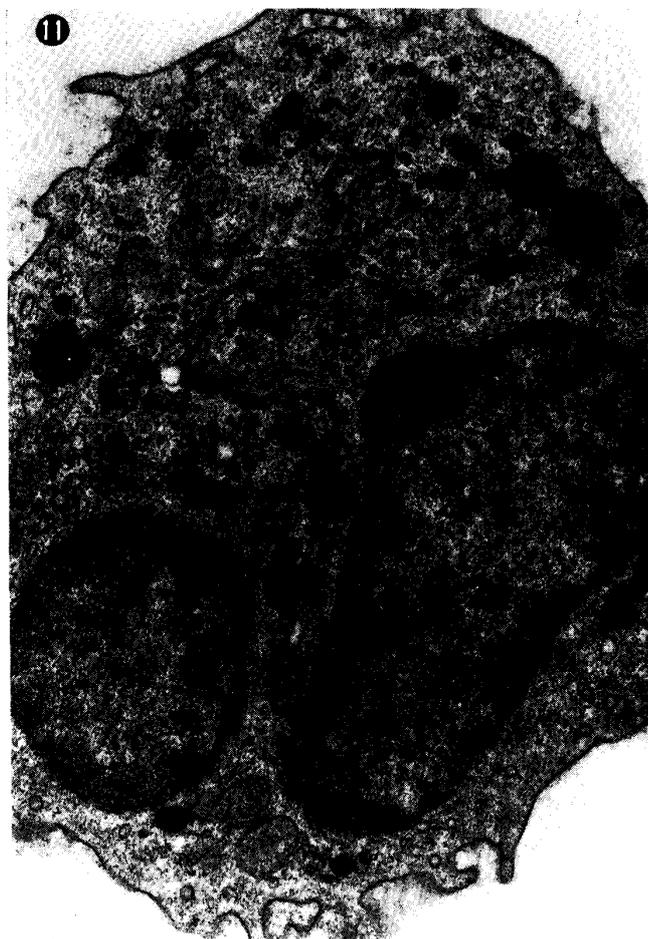


PLATE IV

Fig. 13 A Golgi complex (G) is seen in the cytoplasmic area facing the concave nuclear part. Many dense granules are present collectively in an area of the cytoplasm. One of them is extraordinary large (arrow). Several rough-surfaced endoplasmic reticulum in canalicular form (rE) are evident. Many phagocytic vacuoles are present in the peripheral area of the cytoplasm.

× 17,500

Fig. 14 Many dense granules and several mitochondria are present mixedly in the cytoplasmic area between the two nuclear lobes. Several phagocytic vacuoles are seen in the peripheral area of the cytoplasm.

× 17,500

