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ULTRASTRUCTURAL CHARACTERISTICS OF A PECULIAR LACUNOSE FORMATION IN THE HAIRY CELLS OF HUMAN LEUKEMIC RETICULOENDOTHELIOSIS

Abstract — A peculiar lacunose formation has been observed in the cytoplasm of hairy cells in the peripheral blood of four patients with leukemic reticuloendotheliosis. This formation seems to originate from the modification and fusion of mitochondria, and may interpreted as a sign of degeneration of hairy cells.

Riassunto — *Caratteristiche ultrastrutturali di una particolare formazione lacunosa dei tricoleucociti della reticoloendoteliosi leucemica umana.* Una particolare formazione lacunosa è stata osservata nel citoplasma dei tricoleucociti del sangue periferico di quattro pazienti con reticoloendoteliosi leucemica. Tale formazione sembra originarsi da modificazione e fusione di mitocondri, e può essere interpretata come un segno di degenerazione dei tricoleucociti.

Key words — Ultrastructure / hairy cells / lacunose formation.

INTRODUCTION

In recent years, hairy cell leukemia, or leukemic reticuloendotheliosis, has been investigated by many authors using transmission electron microscopy (PADILLA & SOLOFF, 1971; TRUBOWITZ et al., 1971; GHADIALY & SKINNIDER, 1972; KATAYAMA et al., 1972; CATOVSKY et al., 1974; DANIEL & FLANDRIN, 1974; SCHNITZER & KASS, 1974; STANG-VOSS & MÖBIUS, 1976; BURKE et al., 1976; BOLDT et al., 1977; BOZZI et al., 1980). Hairy cells (or tricholeukocytes) are characterized by the presence of broad-based ruffled membranes and clusters of stub-like microvilli, as can be observed under the scanning electron microscope (GOLOMB et al., 1975; POLLIACK, 1976; GOLOMB & SIMON, 1977). The cytoplasm fre-

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quently shows a large ribosome-lamella complex, which, however, has also been reported in other diseases (STEFANI et al., 1977).

In the present study, I wish to describe a peculiar formation in the hairy cell cytoplasm, which has not yet been reported.

MATERIALS AND METHODS

The blood of four patients with hairy cell leukemia was investigated under the transmission electron microscope. In all cases the diagnosis was based on clinical, hematologic, and cytochemical criteria. The patients were studied at the 2nd Division of Internal Medicine, «F. Lotti» Hospital, Pontedera, and their clinical data have been presented in another report (Bozzi et al., 1980). Nine peripheral blood samples were studied. Blood was processed as a solidified disc of the buffy coat (ANDERSON, 1965). Fixation was performed for 40 min in 5% glutaraldehyde in 0.13 M phosphate buffer (pH 7.3) containing glucose and CaCl_2 at 4° C. After fixation the specimens were washed in phosphate buffer and postfixed in 1% osmium tetroxide for 1 hour.

Dehydration, embedding in Epon-Araldite mixture, sectioning and double staining were all carried out according to routine methods. The sections were examined under a Siemens Elmiskop 1A electron microscope.

RESULTS

The hairy cells observed in all four cases (Fig. 1) are, as usual, a mononuclear cell type, tending to form loose aggregations and sometimes to join up in structural bonds like tight junctions. Only in the hairy cell cytoplasm of case 4 were ribosome-lamella cell complexes found (arrow), whose features can be seen in Fig. 1 inset. In all four cases the cytoplasmic zone is characterized by numerous clustered mitochondria; some of them appear to be markedly swollen, with light matrix and spaced cristae (Fig. 2). In the same region, certain cells show a moderately electrondense formation distinct from the surrounding cytoplasm (Fig. 3). This formation has a lacunose appearance, and is delimited by profiles of double membranes, which may also be observed inside it. The cross-sectional area of this formation is variable; the larger its dimensions, the lower the number of mitochondria adjacent

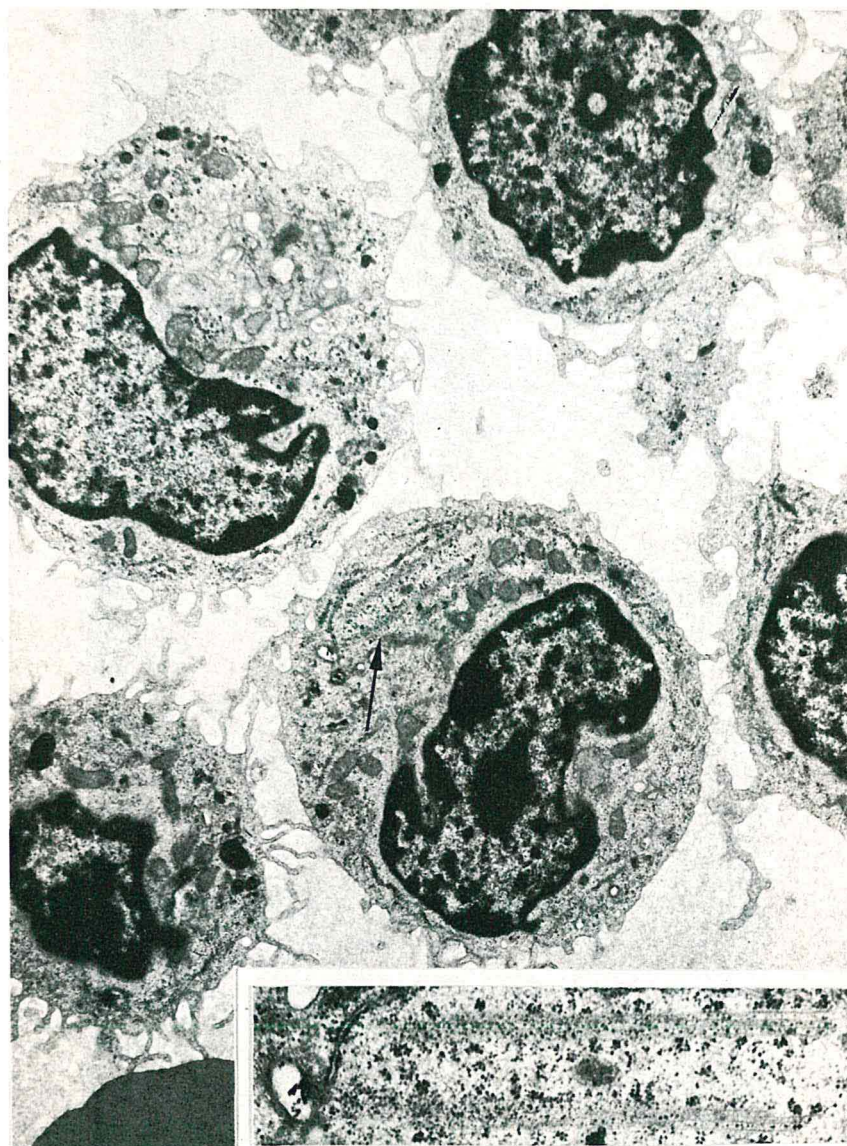


Fig. 1 - General view of hairy cells. Arrow indicates a ribosome-lamella complex. $\times 5000$.
INSET - Magnification of ribosome-lamella complex. $\times 21000$.

to it. At high magnification, the inner arrangement of double membranes generates a system of laminar spaces varying in size, which subdivide the formation into various communicating compartments (Fig.



Fig. 2 - Hairy cell containing a very swollen mitochondrion with light matrix and spaced cristae. $\times 72000$.

4). Some hairy cells show a clearly modified cytoplasm, with a more diffuse lacunose formation; the remaining mitochondria accumulate near it and show degenerative features (Fig. 5).

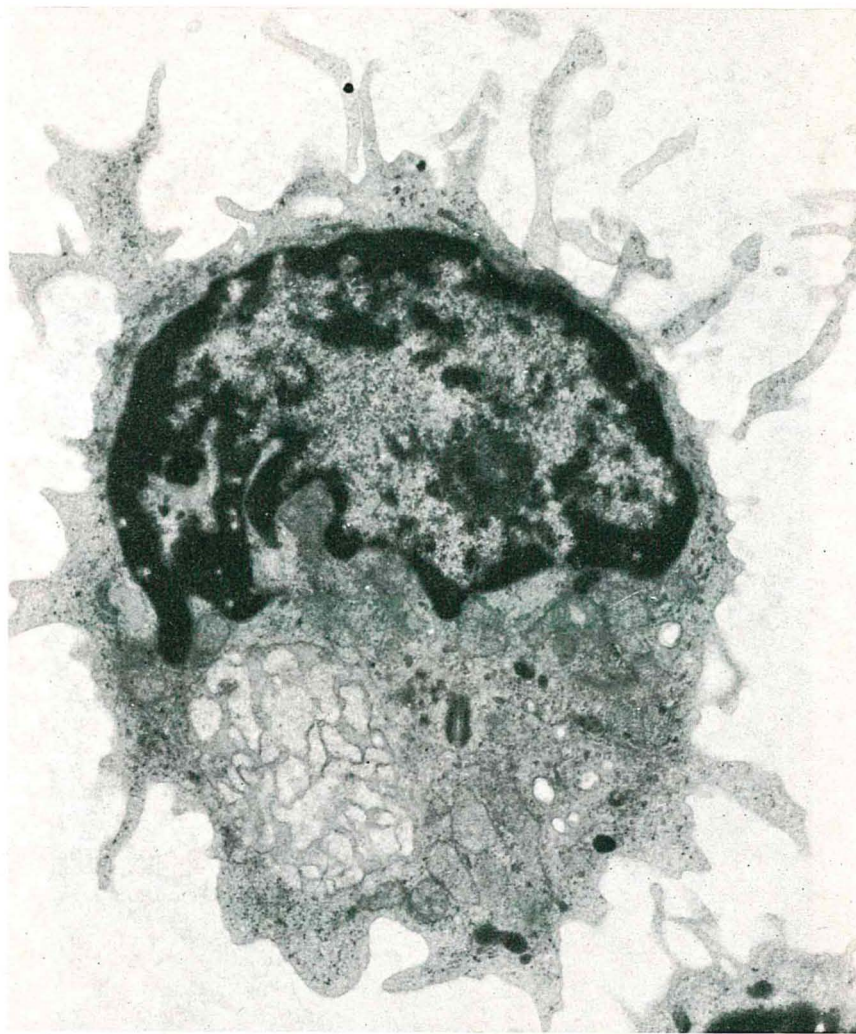


Fig. 3 - Hairy cell containing large lacunose formation. $\times 11500$.

DISCUSSION

It has been previously reported that hairy cells sometimes show ribosome-lamella complexes, whose granular component has been demonstrated to be ribosomal in nature. The lamellar component of these tubular structures is formed by an arithmetic coil; topographical-

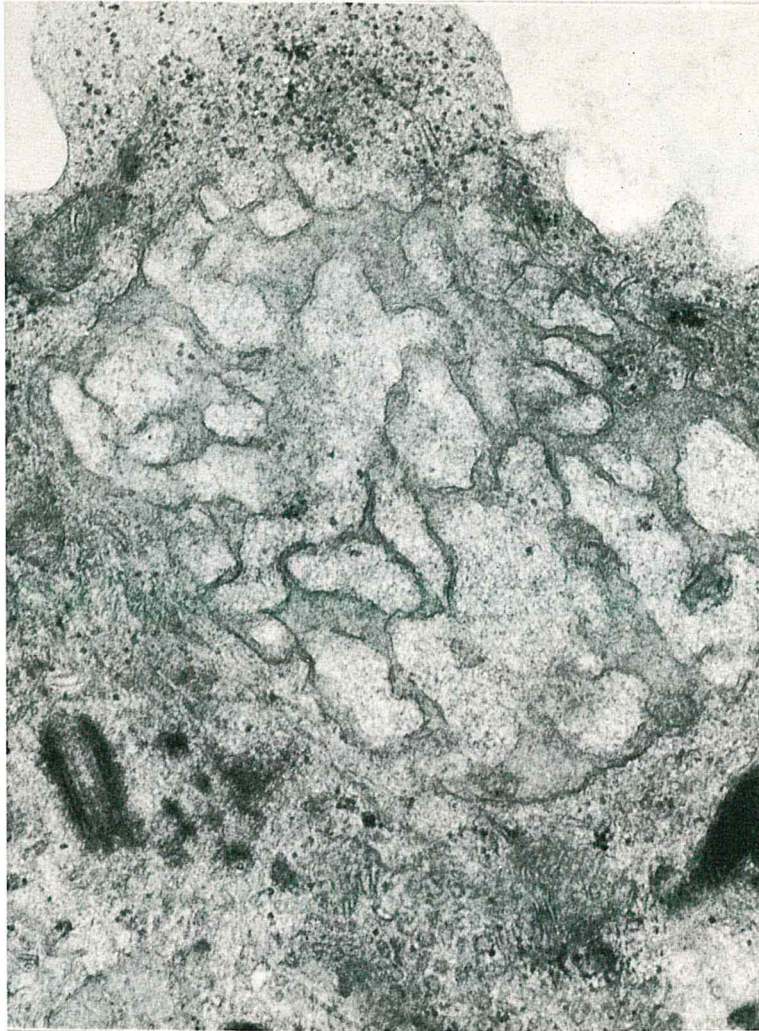


Fig. 4 - Magnification of lacunose formation subdivided into various compartments by double membranes delimiting laminar spaces. $\times 34000$.

ly the tubular structures appear to be closely related to the endoplasmic reticulum (DANIEL & FLANDRIN, 1974). In contrast, the lacunose formations observed in the hairy cells of the four patients here reported seem to originate from the modification and fusion of mitochondria. Large numbers of mitochondria, sometimes showing swelling and loss of cristae, are observed in tumor cells, such as oncocytes, eosinophilic cells

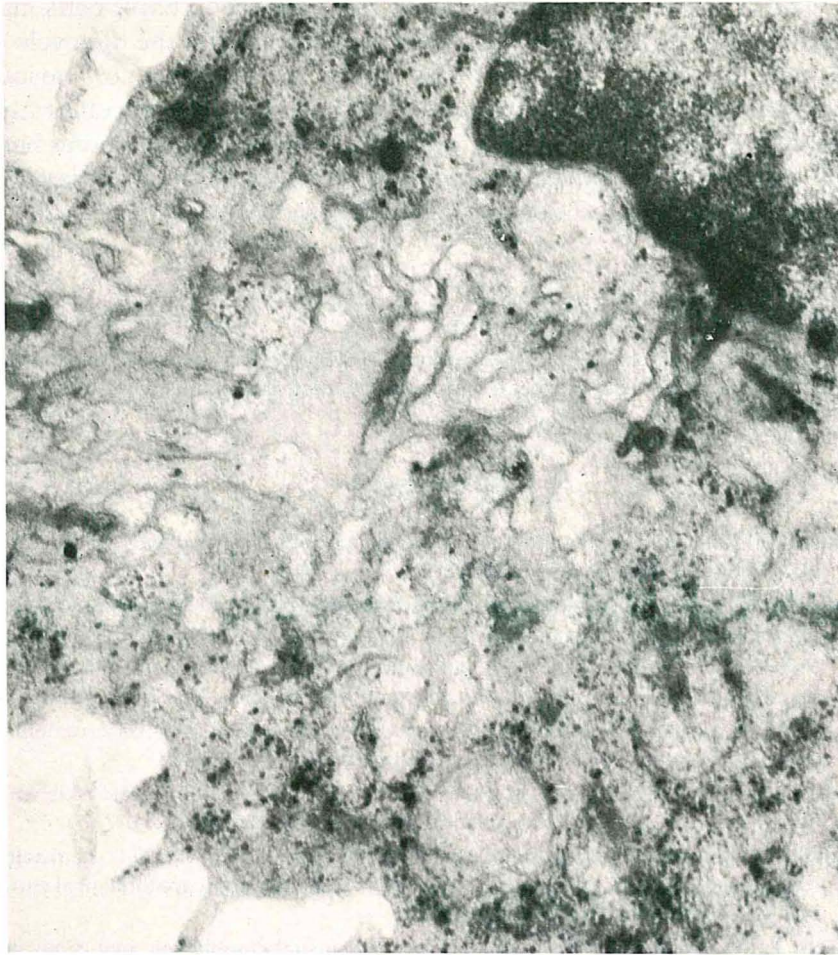


Fig. 5 - Wide cytoplasmic zone in hairy cell with mitochondria and lacunose formation showing diffuse degenerative features. $\times 30500$.

in parathyroid glands, Hurthle cells in the thyroid gland, and the epithelial component of Warthin's tumor (SANTOS-BRIZ et al., 1977). In the pathological material here studied, the double mitochondrial membranes can be seen to participate in the constitution of the lacunose formation. Furthermore, the number of mitochondria near the formation decreases as the formation increases in size, until it occupies a large proportion of the cytoplasm. Naturally, it cannot be excluded that other cytoplasmic components contribute to its constitution too.

This morphologic transformation taking place in hairy cells may be interpreted as a degenerative feature signaling that the life-cycle of the cells is ending. On the other hand, the presence of various cytoplasmic inclusions has been observed in several myeloproliferative disorders (COPPOLA & O'CONNOR, 1977), and some inclusion bodies have been interpreted as initial degenerative changes of the cytoplasm of such cells (COPPOLA & O'CONNOR, 1977; BESSIS, 1972).

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