Electron Microscopy of the Skin of a Greenlandic Mummy

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This study was carried out during the archaelogical examination of a Greenlandic mummy by the Danish National Museum.
A nodule on the dorsal surface of the right fourth finger of a 500-year-old mummy from Greenland was studied by electron microscopy. The tissue showed outlines of tissue components such as keratinocytes, melanocytes, vessels, nerves, and histiocytes as well as collagen and elastic fibres.

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In 1972 eight mummified bodies were found under a rock shelter in Qilakitsoq, West Greenland. The bodies had been well preserved by the extremely cold and dry polar weather. The bodies were thought to be from the fifteenth century. Skin from an embalmed mummy from Egypt, about 2000 years old, has been studied by electron microscopy (Hino *et al.* 1982a, 1982b). This study deals with skin of a non-embalmed mummy found in Greenland.

Material and methods

There was a wart-like nodule on the dorsal surface of the fourth middle phalanx in one of the female mummified bodies (no. II/7). The nodule was brownish, round, about 0.5 cm across, and covered with scales. The tissue was immersed and rehydrated in a cacodylate buffer, 0.05 M, pH 7.3, with 7.5% sucrose, for three days in a refrigerator.

The tissue was then cut into slices about 2 mm thick and fixed in 6% glutaraldehyde solution of the same buffer for 48 hours in a refrigerator. The tissue slices were further divided in small blocks, osmicated, dehydrated and embedded in Epon 812. Ultrathin sections were cut by a Reichert ultramicrotome and contrasted by uranyl acetate and lead citrate. A JEOL electron microscope 100 CX was operated at 80 KV for observation.

Findings

The *epidermis* consisted of several layers of horny plates and prickle cell layers. Though the cytoplasm of the epidermal cells appeared dense and homogeneous, some of the cellular components such as cell borders, interdigitations and desmosomes were recognized (Fig. 1). Intercellular spaces were narrow. Desmosomes showed dense thickenings of cell membrane on both sides and an intercellular band with narrow lucent spaces adjacent to the dense cell membrane. Occasionally, the intercellular band showed a faint middle line in the lower Malpighian cells (Fig. 2). Irregularly shaped nuclei contained dense peripheral chromatin and a lucent central area with some dense spots. Nucleoli were not found (Fig. 3). The cytoplasm was diffusely dense without recognizable tonofilament bundles. Faint lucent patterns suggesting some cell organelles such as mitochondira and vesicles were seen (Fig. 2). Keratohyalin granules in dendritic forms and oval melanin granules were seen (Fig. 3). Melanocytes with melanosomes were also found. However, internal structures of the melanosomes were not seen (Fig. 4). Cytoplasm and nuclei of the melanocytes appeared identical to those of the keratinocytes.

Dermo-epidermal junction. Basal lamina was seen to be structureless and of irregular thickness. No semidesmosomes, anchoring filaments nor anchoring fibrils were seen (Fig. 4).

Corium appeared as compact plates of collagen fibrils (Fig. 5). Elastic fibres, vessels, nerves and some cells were also recognized in the corium. Microorganisms were found in the dermis (Fig. 8). The collagen fibrils formed thick bundles without interfibrillar spaces (Fig.

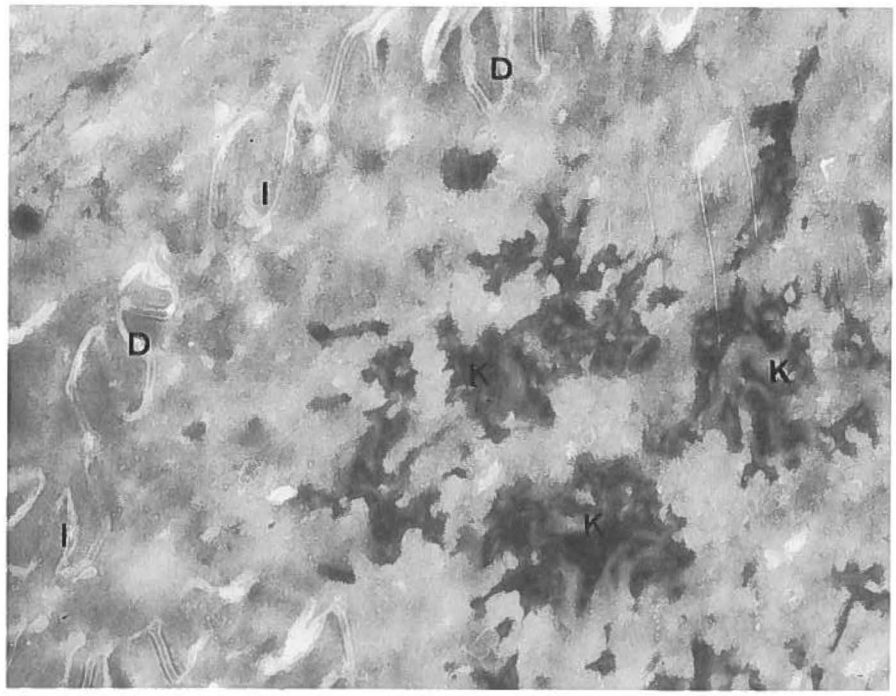

Fig. 1. A keratinocyte of the granular cell layer show keratohyalin granules of dendritic forms (K), desmosomes (D) and interdigitations (I). No tonofilament bundles are visible.
X 30,000.

6).The fibrils showed an axial periodicity of about 66 nm. The fibril diameters seem to be about 70–100 nm with blurred contours. Elastic fibres showed transparent and opaque bands without fibrillar structures (Fig. 6). Vascular endothelium and perivascular cells could be identified by their forms (Fig. 7). Nuclei, dense homogeneous cytoplasm with lucent patterns of cell organelles and interdigitations of cytoplasmic protrusions were seen. Perineurium, endoneurium and Schwann cells were identifiable (Fig. 8). However, their cytoplasmic appearances were similar to those of other cells described above. Axons were not seen. Endoneural col-

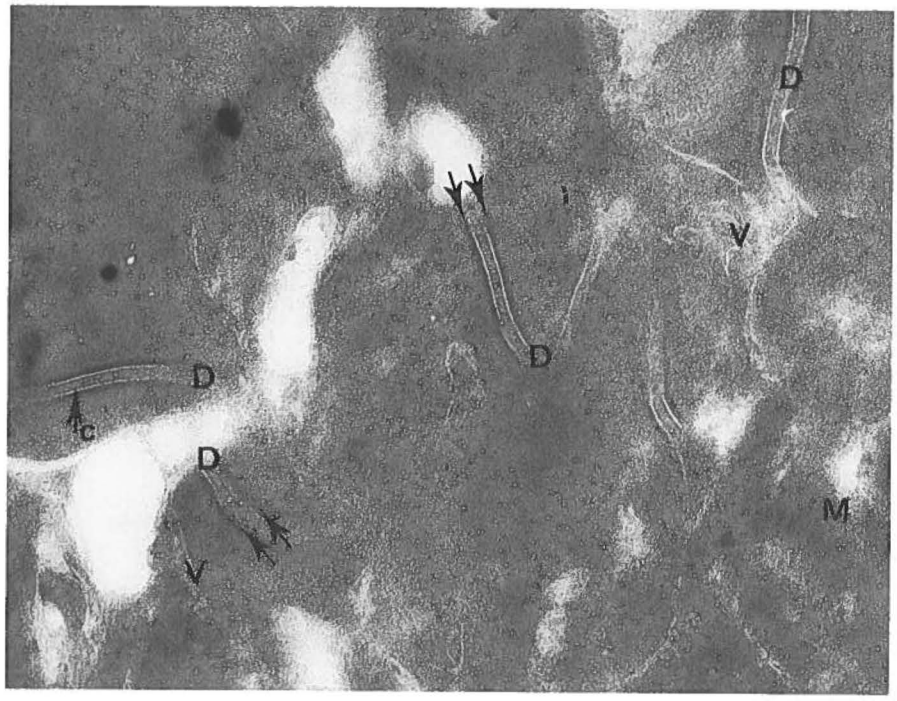

Fig. 2. Desmosomes (D) show dense thickened cell membrane (arrows) and a central band. Arrow c indicates a faint median line. Faint lucent patterns in the cytoplasm are assumed to be mitochondria (M) and vesicles (V).
X 60,000.

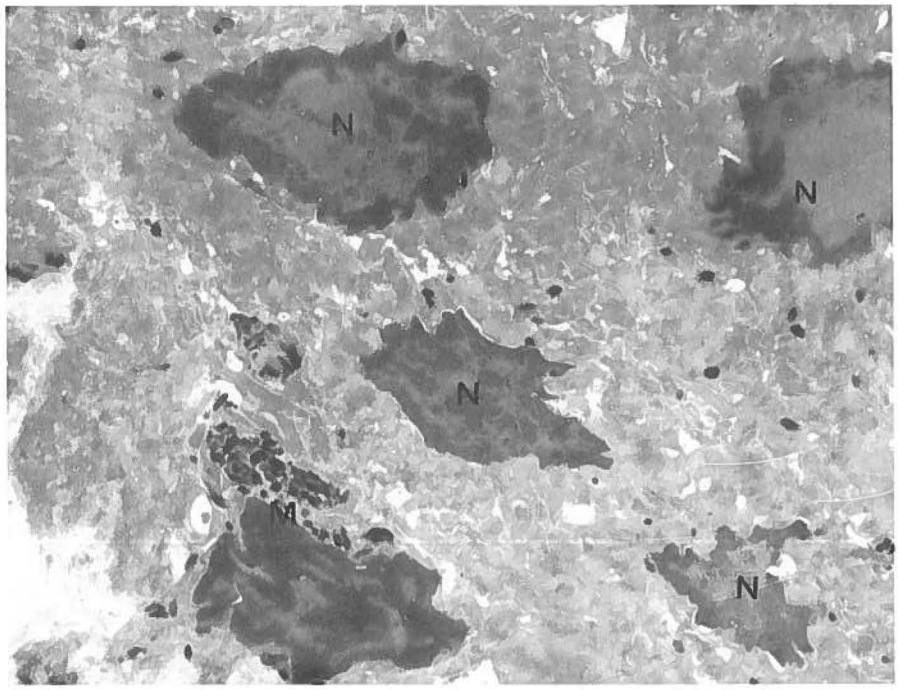

Fig. 3. The lower Malpighian and basal cell layers. Melanocytes (M). Nuclei (N) show dense peripheral chromatin and a lucent centre.
X 7,800.

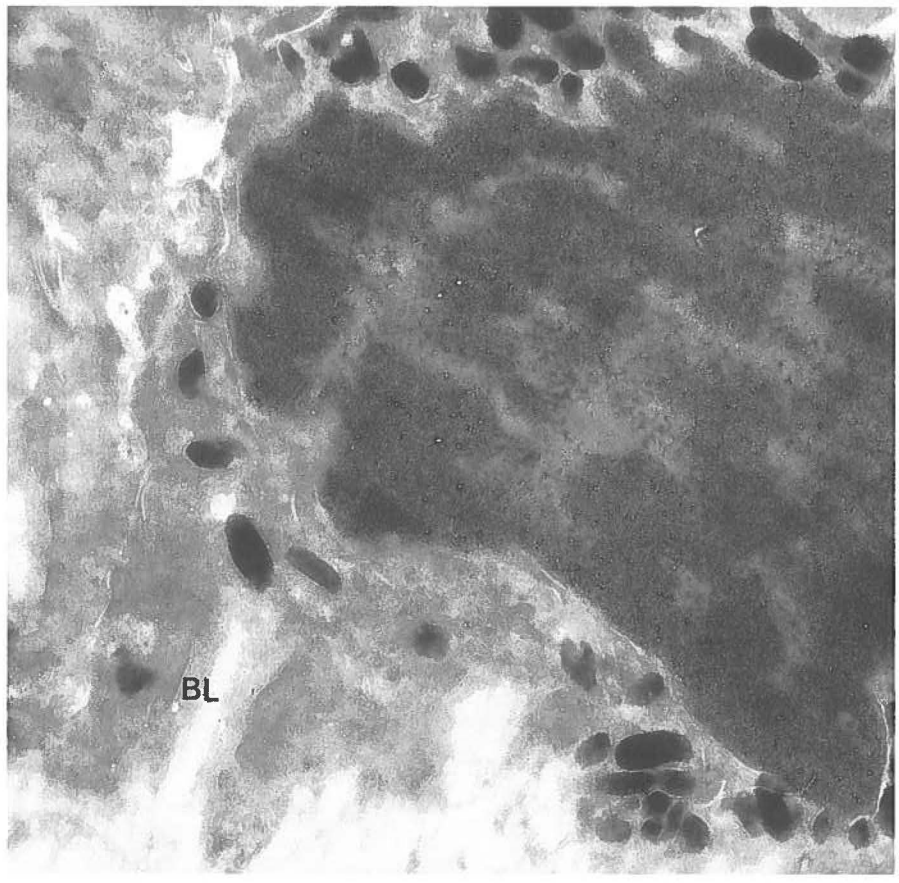

Fig. 4. A melanocyte with numerous melanosomes, appearing dense and without internal structure. Basal lamina (BL) appears as a blurred band.
X 26,400.

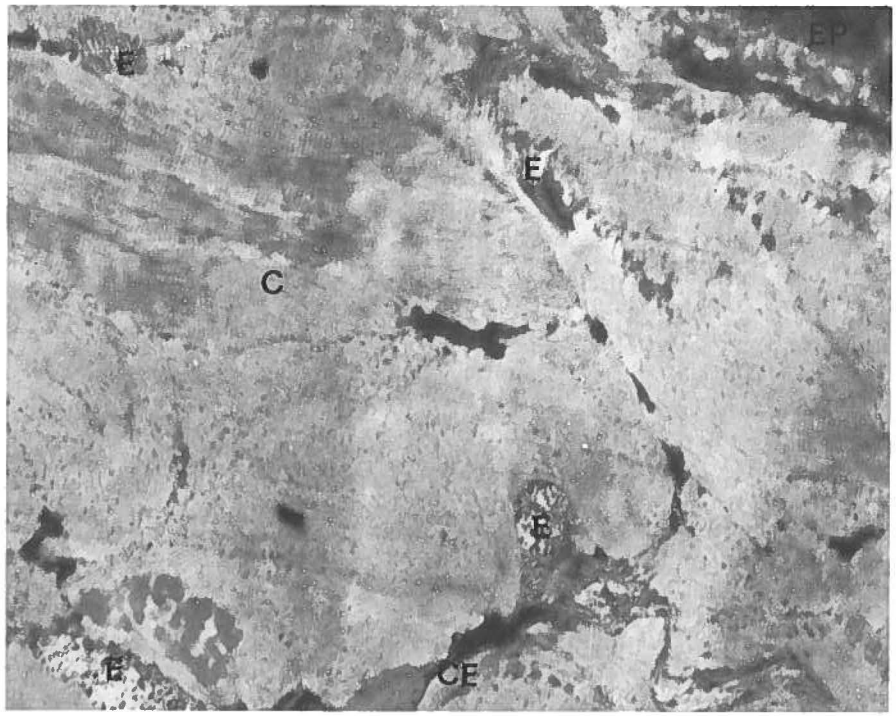

Fig. 5. The dermis consists of compact bundles of collagen fibrils (C) with elastic fibres (E) and cells (CE). Epidermis (EP).
X 15,000.

lagen fibrils were about 30 nm across. Phagocytes with vesicles and large dense granules were found in the corium (Fig. 6).

Comments

Present findings of tissue structures demonstrated that the mummy skin preserved outlines of tissue compo-

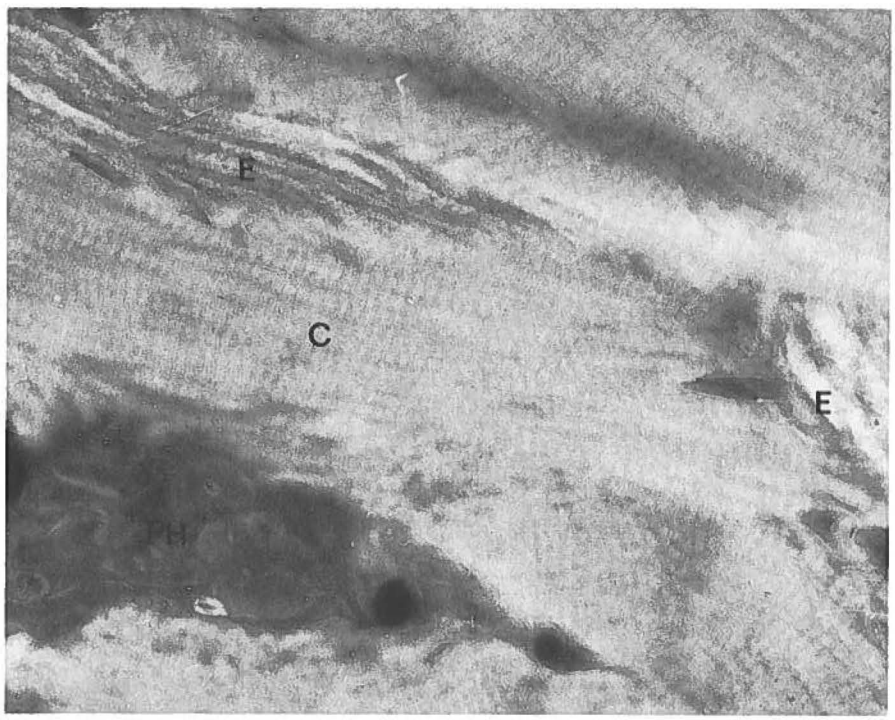

Fig. 6. The collagen fibrils (C) show axial periodicity. Elastic fibres (E) form dense and lucent bands. A phagocyte (PH) shows lucent patterns in its cytoplasm.
X 26,400.

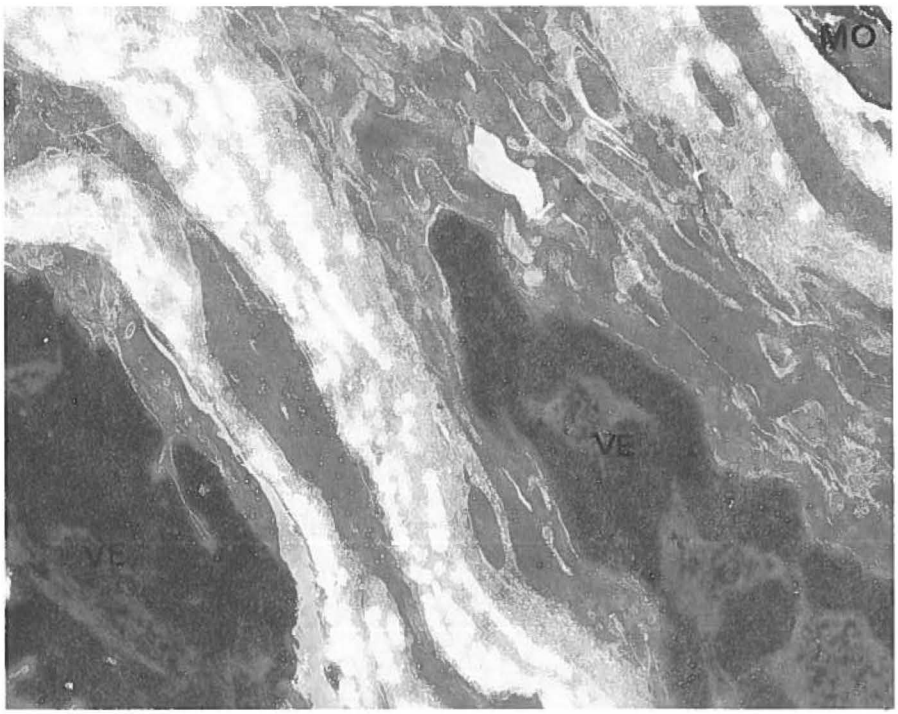

Fig. 7. Vascular endothelial cells (VE) and microorganism (MO).
X 26,400.

nents. However, detailed structures of cells and fibres were incompletely demonstrated. Multiple layers of horny plates and keratinocytes with keratohyalin granules led to the presumption that the nodule was callous. Intracytoplasmic, faintly lucent patterns have been noted in an Egyptian mummy in previous papers (Hino *et al.* 1982a, 1982b). Axial periodicity of the collagen fibrils was identical to that of present-day humans and

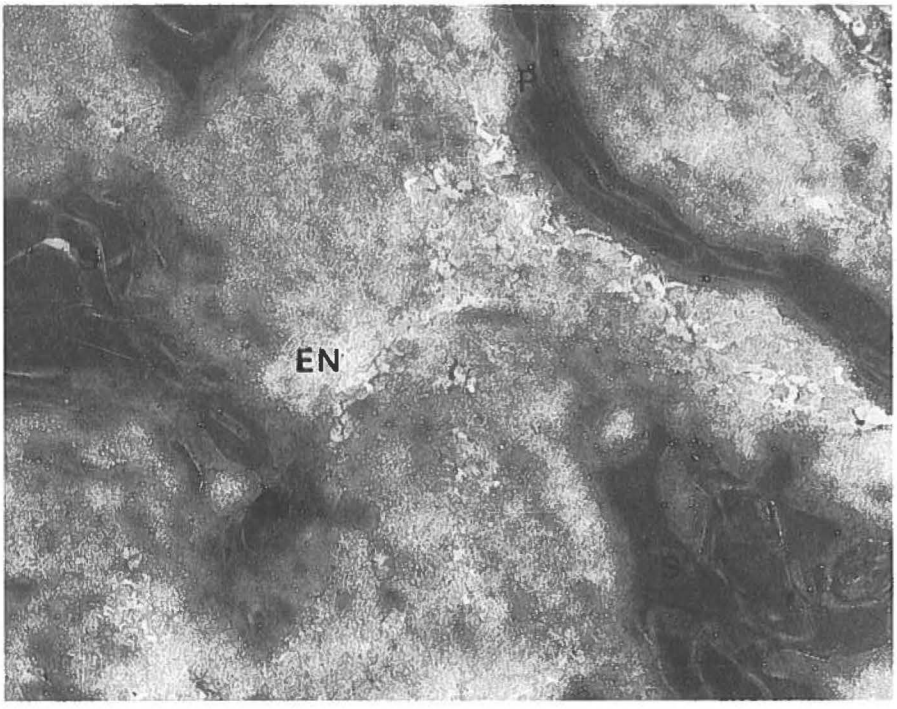

Fig. 8. A nerve shows perineurium (P), Schwann cells (S) and endoneurium (EN).
X 30,000.

shows cross bands clearer than the embalmed Egyptian mummy (Hino *et al.* 1982a, 1982b). Microorganisms were also found in the Egyptian mummy under the dermis (Hino *et al.* 1982b)

References

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