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ELECTRON MICROSCOPIC STUDY OF NEVIC CORPUSCLE

Kan Niizuma

From the Department of Dermatology, Tokai University School of Medicine, Bohseidai, Isehara-city, Japan

Abstract. An intradermal nevus, in which a number of nevic corpuscles were clearly observed, was studied, using the electron microscope. Nevic corpuscles contained laminated cells consisting of flattened cytoplasmic processes stretching across the corpuscles to form a complicated labyrinth. The perikaryon of these cells contained premelanosome-like dense bodies and other organelles including mitochondria, rough-surfaced endoplasmic reticulum, free ribosomes, and Golgi apparatus. Neither axons nor dendrites were found in these areas. From these observations, it was concluded that the nevic corpuscles were composed exclusively of nevus cells and could be clearly distinguished from Meissner corpuscles. This view would support the idea of a unitary origin of nevus cells. In addition, an isolated cilium found in a laminated cell is briefly described.

Key words: Nevic corpuscle; Intradermal nevus; Premelanosome; Melanosome; Meissner corpuscle; Isolated cilium

Few reports have been published on electron microscopic observations of the nevic corpuscles (7, 11).

In this report, an intradermal nevus, which histologically exhibited numerous fine nevic corpuscles, was studied using the electron microscope. The observations focus on the ultrastructure of the cells making up the nevic corpuscles, and the discussion concerns the origin of these cells.

METHODS AND MATERIALS

The specimen was initially fixed for routine histological observation in buffered neutral formalin solution for 3 days. It was cut into 1-mm^3 cubes, and rinsed in 2% sucrose 1/10 M phosphate buffer (pH 7.4) overnight. Subsequently, the cubes were post-fixed with 1% osmic acid in the same buffer for 2 hours. These specimens were dehydrated in graded ethanol, and embedded in Epon 812 according to the method of Luft (5). Ultrathin sections were cut in an LKB ultramicrotome and were doubly stained with uranyl acetate and Reynold's lead citrate. The stained sections were observed in a JEM-100B electron microscope with an accelerating voltage of 80 kV.

A 20-year-old Japanese female had a light-brown colored, dome-shaped skin lesion in the occipital area, measuring about 8 × 8 mm. When the lesion was first noticed around 10 years ago, it was 2 × 2 mm sized lump. The lesion gradually increased in size, and was excised. It was histologically diagnosed as an intradermal nevus which included a number of nevic corpuscles.

RESULTS

Light microscopy

The lesion was roughly demarcated into three zones composed of A-, B-, and C-type nevus cells. The nevic corpuscles were usually located at the periphery of these nevus cell areas (Fig. 1A). Following above investigations they were composed of parallel arrays of fine anastomosing filamentous structures (Fig. 1B). They stained bluish pink with Mallory's staining, and yellowish pink with Van Gieson's technique. The Sudan III staining did not reveal any stainable fat. Elastic fibers were not seen in these corpuscles.

Electron microscopy

Low magnification of a nevic corpuscle (Fig. 2) reveals a general arrangement of its various components. It was composed largely of flattened and cylindrical cytoplasmic processes arranged in a laminated, occasionally interlacing and whorled fashion. These processes varied greatly in size, and some of them appeared to extend from the cytoplasm of the surrounding laminated cells. In the periphery of the nevic corpuscles the laminated cells had a typical basal lamina. Not every process, however, was surrounded by a basal lamina. These laminated cells were the only cellular components of the corpuscles. The laminated cell nucleus was generally indented, finely granular, and contained one nucleolus or more. Other characteristic features of the laminated cell were the presence of an isolated

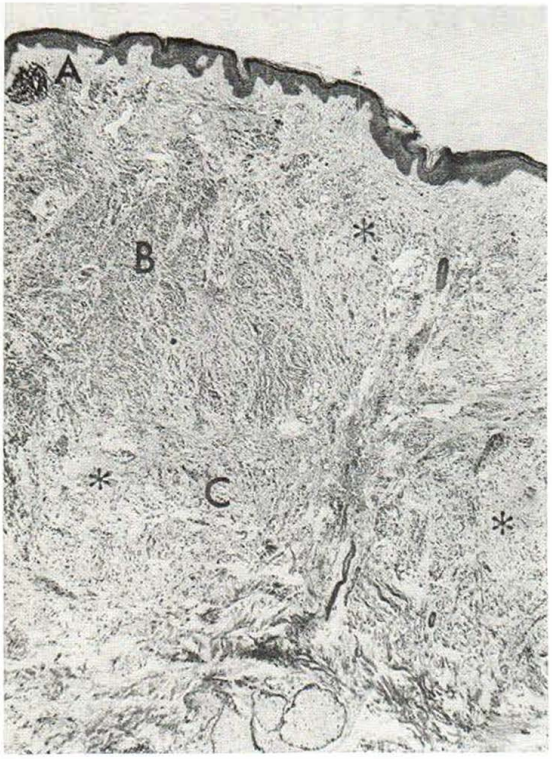

Fig. 1A. Low magnification light micrograph of the specimen (intradermal nevus). Hematoxylin and eosin stain. *A*, A-type nevus cells; *B*, B-type nevus cells; *C*, C-type nevus cells. Asterisks: nevic corpuscles. × 36.

cilium and several premelanosome-like dense bodies (Fig. 2, inset).

The perinuclear cytoplasm of the laminated cell (Fig. 3) contained mitochondria, rough-surfaced endoplasmic reticulum, free ribosomes, isolated cilium, Golgi complex, and several premelanosome-like dense bodies. Also in the perinuclear cytoplasm were numerous fine fibrils, 8 nm thick. The premelanosome-like dense bodies appeared almost spherical and varied in size and electron density. Their diameters ranged from 100 nm to 300 nm. The earliest stages of these structures had the appearance of small vesicles located in the Golgi area. Some of the dense bodies contained a few coarse electron-dense particles. The internal structures of the largest of these dense bodies contained a finely granular material exhibiting a characteristic electron-dense striation with a periodicity of 70 Å.

There were several spherical premelanosomes in the cytoplasm of the C-type nevus cell juxtaposed to the examined nevic corpuscle (Fig. 4). A very close structural resemblance could be seen between these premelanosomes and the premelanosome-like dense bodies just mentioned above.

From these findings, the premelanosome-like dense bodies are identified as "premelanosomes".

In the processes (Fig. 5), there were occasional mitochondria, rough-surfaced endoplasmic reticulum, free ribosomes, and multivesicular bodies. There were also numerous fine fibrils similar to those mentioned in the perinuclear cytoplasm of the laminated cells. In some areas of the processes, there were vesicles seemingly formed by the invagination of the cytoplasmic membrane along the edge of the cellular process. Junctional complex like structures were occasionally observed between neighbouring laminated processes. Randomly oriented mature collagen fibers 500 Å in diameter could be seen between processes.

DISCUSSION

The nevic corpuscle is defined by Masson as a complex form of foliated lamina—lames foliacées—which term he applied for the first time in 1926. It is also said that the nevic corpuscle is very similar

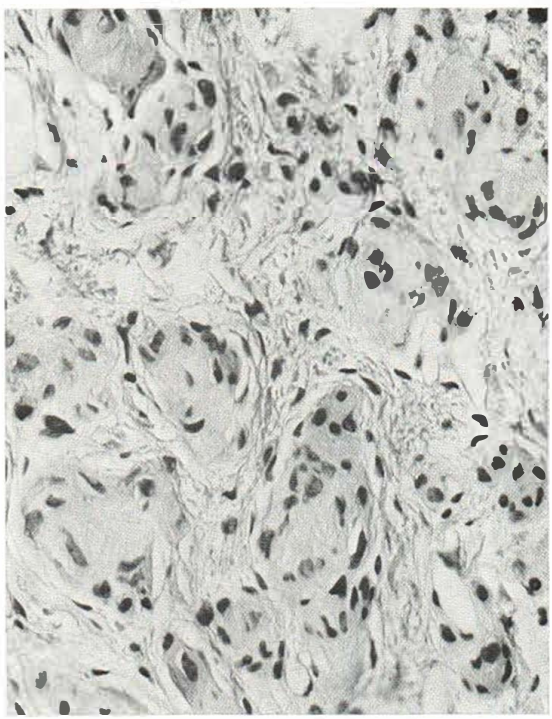

Fig. 1B. High-power view of several nevic corpuscles (marked asterisk in Fig. 1A). Laminated structures resembling Meissner corpuscles are demonstrated. × 330.

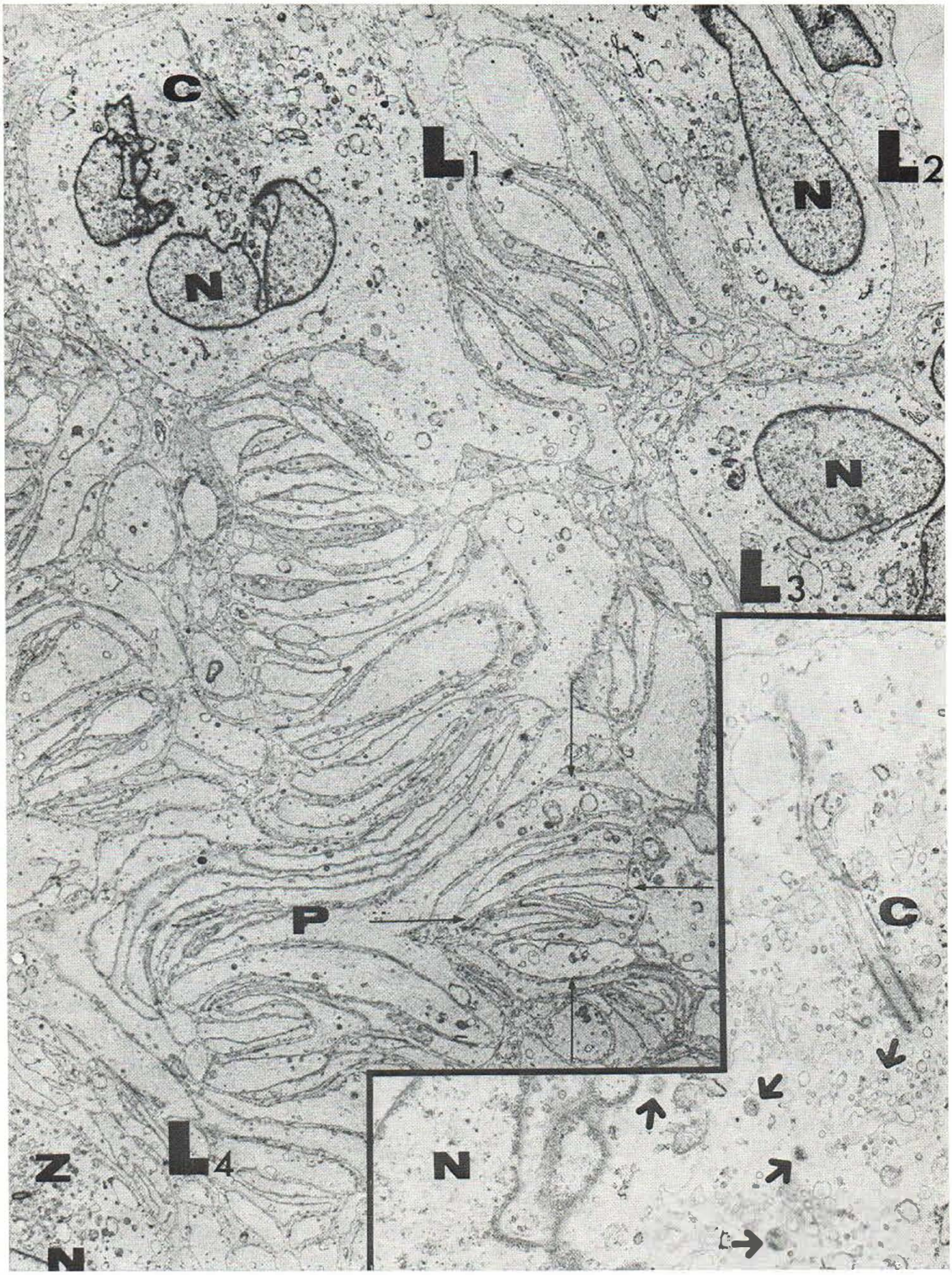

Fig. 2. A general view of a nevic corpuscle. Four laminated cells (L_1, L_2, L_3, L_4) are seen at the periphery of the picture. Laminated cytoplasmic processes (*P*) make up the bulk of the structure. No other cells, including Schwann cells, axons or dendrites of neuronal cells, are identified in the corpuscle. × 4 800. *Inset:* Enlargement of the central area of cell marked "L_1" (upper left portion). Around the isolated cilium, several premelanosome-like dense bodies (*arrows*) are present. × 13 000. *C*, Isolated cilium; *N*, nucleus; *Z*, centriole.

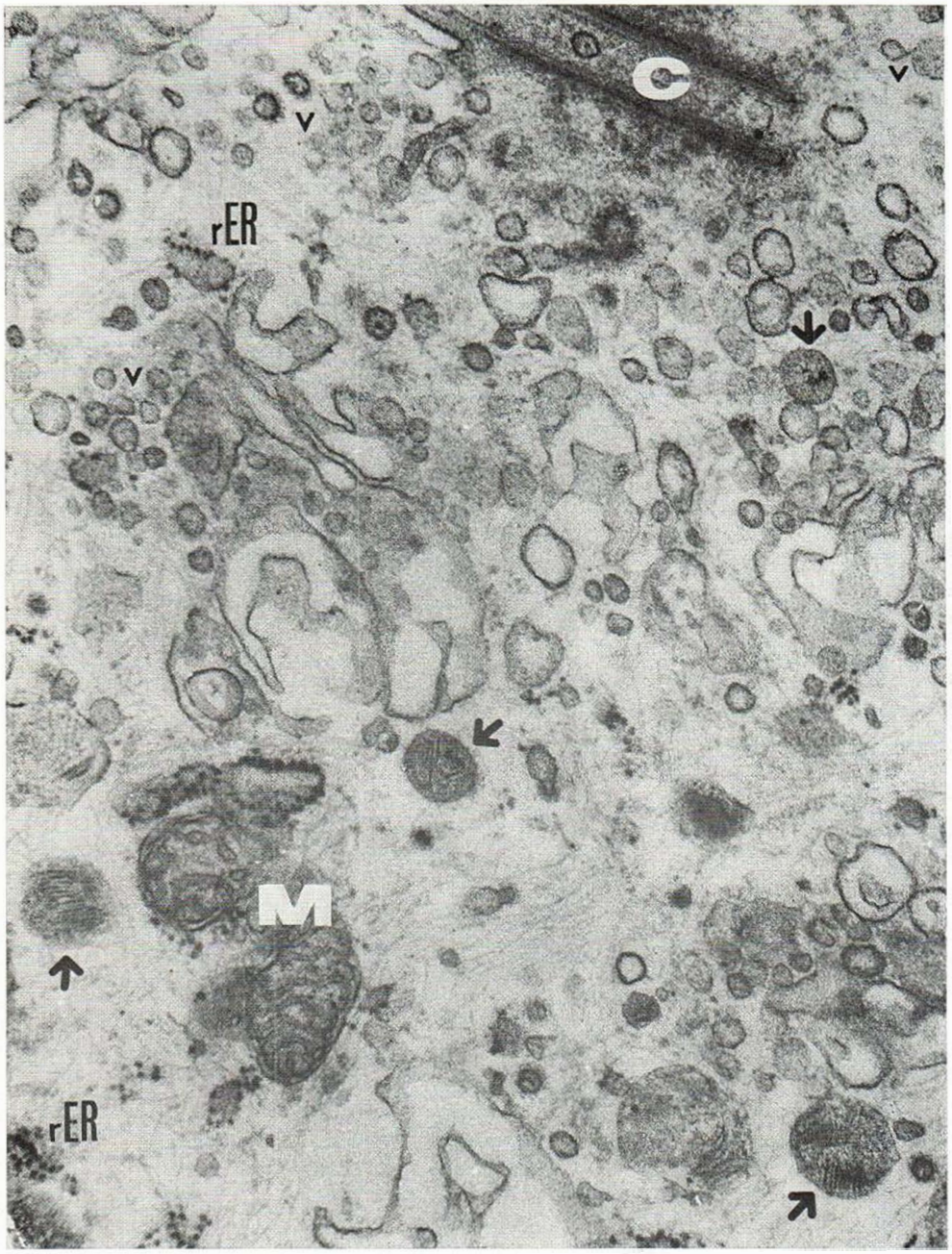

Fig. 3. Higher magnified view of Golgi area at the cell marked "L_1" in Fig. 2. Rootlet (*C*) of the isolated cilium is surrounded by numerous vesicles (*v*). Several premelanosome-like dense bodies (*arrows*) exhibit characteristic electron-dense striations with a periodicity of approximately 70 Å. *M*, Mitochondria; *rER*, rough-surfaced endoplasmic reticulum. × 43 000.

to a normal Meissner corpuscle except for a slight difference and he stresses that the nevic corpuscle is a nervous component of nevus cell nevus. He believes that intradermal nevus cells have a dual origin, i.e., the superficial intradermal cells come from detached junction nevus cells of the epidermis whereas the deeper cells represent malformations and proliferations of Schwann sheath cells (6).

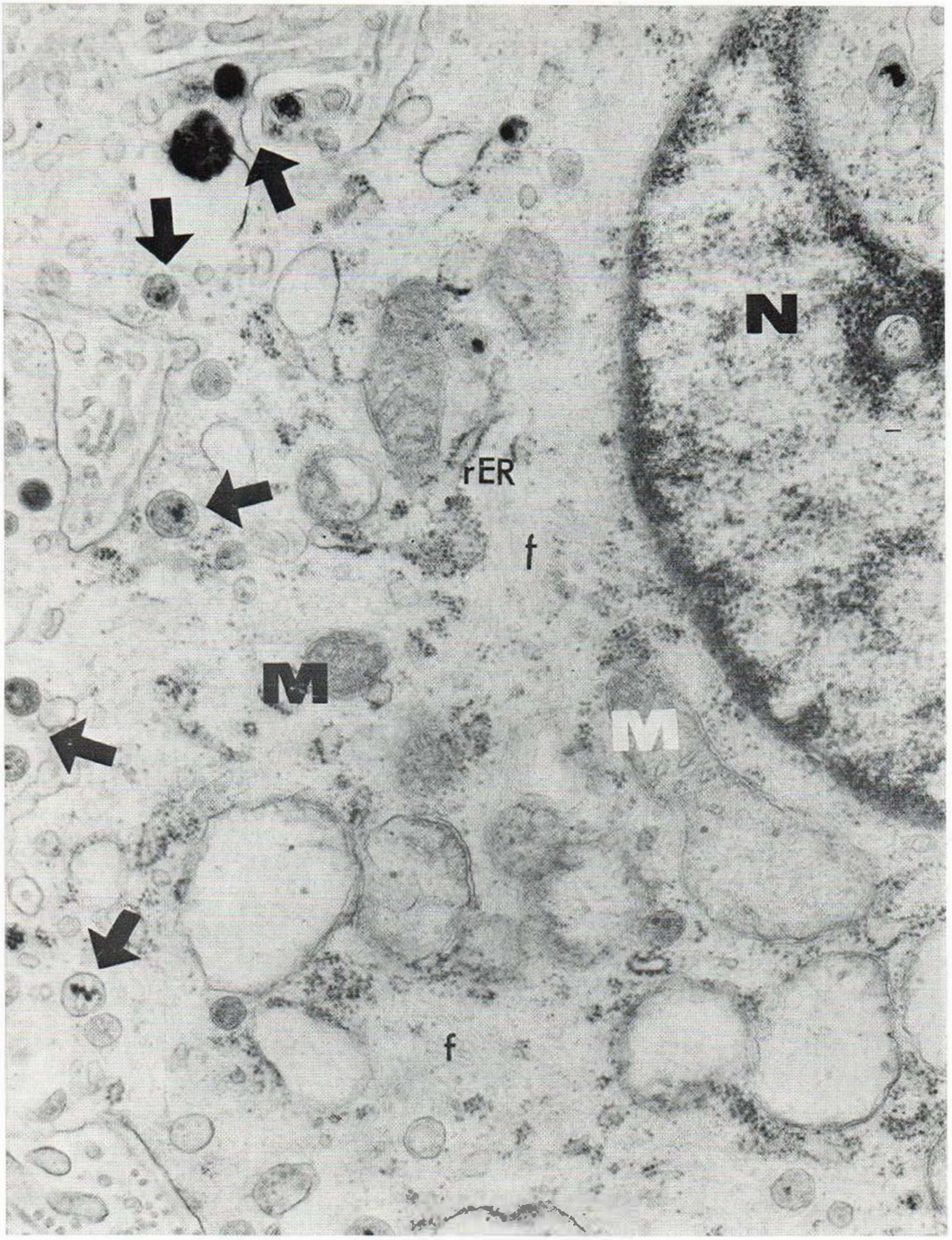

Fig. 4. Premelanosomes in the C-type nevus cell juxtaposed to the nevic corpuscle are indicated by arrows. A very close resemblance is found between these premelanosomes and premelanosome-like dense bodies in Fig. 3. *M*, Mitochondria; *N*, nucleus; *rER*, rough-surfaced endoplasmic reticulum; *v*, vesicle. ✳: invagination. × 33 000.

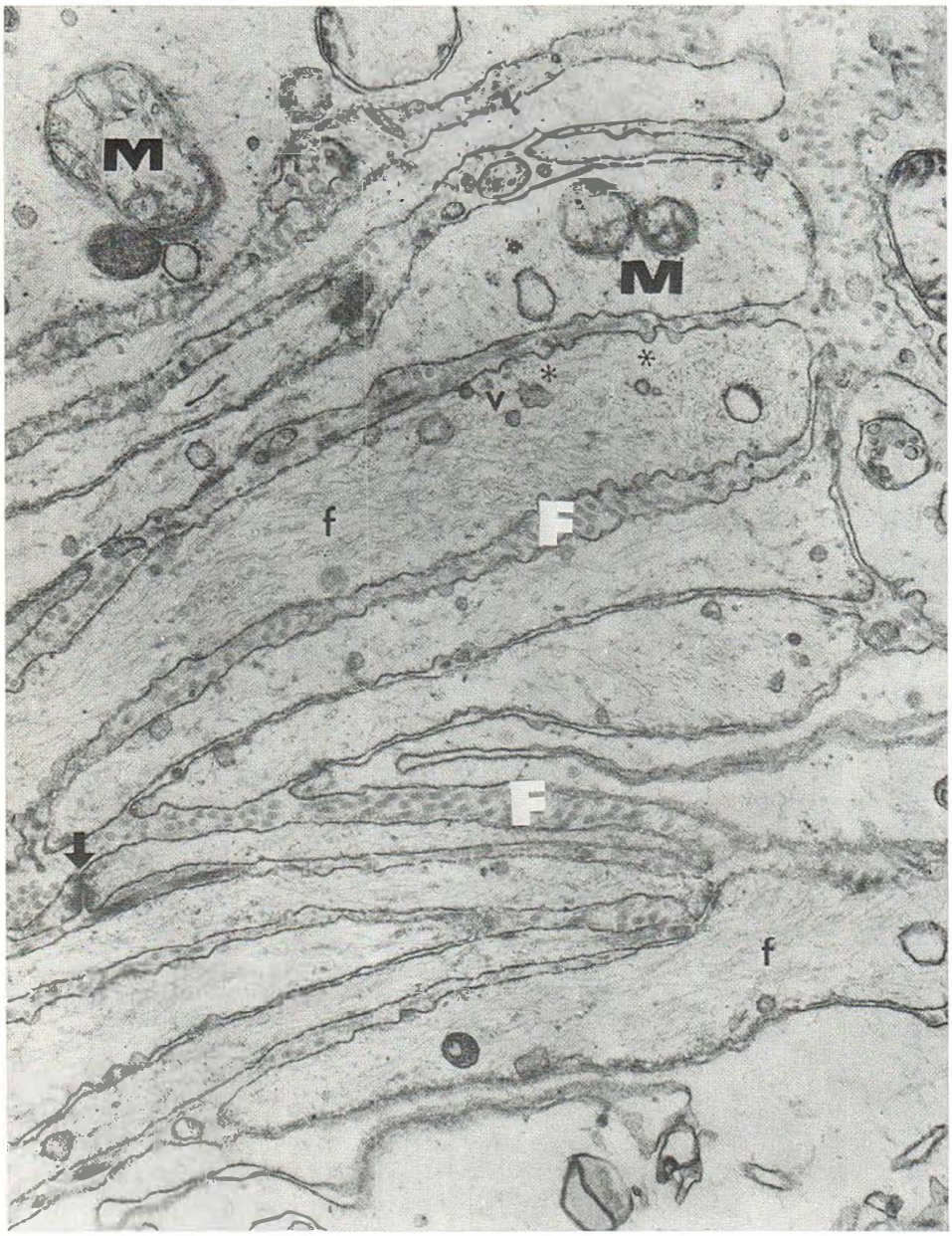

Fig. 5. High-power view of the laminated processes at the area surrounded by four thin arrows in Fig. 2. The processes contain various subcellular organelles and show a junctional complex-like structure (*arrow*). *M*, Mitochondria; *F*, collagen fibers; *f*, fine filaments. × 25 000.

Kawamura insists upon the theory of a unitary origin of nevus cells deriving from abnormal neural crest cells (4)—nevoblasts (10). Within the resolution limit of the light microscope, however, confusion may exist in histologic findings of both investigations.

Pool (11) reported that nevic corpuscles were quite similar to Meissner corpuscles in his electron microscopic observations. He supported the view that the nevic corpuscles were of neural origin. In his report, however, the structural similarities between the nevic corpuscles and Meissner corpuscles were confirmed

by comparing mostly the laminated cellular cytoplasmic processes of the nevic corpuscle and the processes of the laminar cell of Meissner corpuscle. The comparison was not based on the features of the perikaryon, nucleus or other components of these cells. Pool's studies contained no descriptions of the peripheral nerve endings, such as axons which are the essential components of Meissner corpuscles.

Mishima (7) described how the neuroid structures in the C-type nevus cells are primarily composed of cytoplasmic lamellae which appear to be contiguous with cytoplasmic elongations of C-type nevus cells and whose ultrastructure is strikingly similar to that of Meissner corpuscles. In his report, there was no precise description of the ultrastructure of these neuroid structures in comparison with the Meissner corpuscle.

According to the other studies on the Meissner corpuscles (9, 2, 3), they appear to be made up of three principal components, viz. (i) laminar cell, (ii) axon, and (iii) capsule and intracellular substance. Meissner corpuscles invariably contain axons. Premelanosomes are not present in Meissner corpuscles.

In this investigation, nine nevic corpuscles were examined by electron microscope and two of them studied by serial sections, but no peripheral nerve endings such as axons or dendrites were ever found in this material.

It would appear difficult to distinguish the premelanosome-like dense bodies from lysosomes. However, some of the premelanosome-like dense bodies have a finely granular, striated appearance with a periodicity of 70 Å (Fig. 3) and these structures are very similar to those of the premelanosomes found in the cytoplasm of C-type nevus cells juxtaposed to the investigated nevic corpuscles (Fig. 4).

From this observation, it is concluded that the nevic corpuscle is not a Meissner corpuscle but only nevus cells. However, in order to verify this concept, it would be necessary to collect additional cases and findings and discuss more precisely the ultrastructure of premelanosome-like dense bodies in the laminated cells of nevic corpuscles in relation to premelanosomes, by evaluation based on the DOPA reaction and other techniques.

Concerning an isolated cilium, there are many reports mentioning its unexpected presence in many kind of cells such as normal human epidermal cells and some of its tumors (12), nevus cells (8), and many other organs (1), but there has as yet been no report of an isolated cilium found in the laminated cell of the nevic corpuscle.

Unfortunately, it has not been able to obtain a cross section of the isolated cilium in this material. Therefore, it has not been possible to clarify the fiber pattern and other precise structures of this isolated cilium. The function of an isolated cilium remains unknown yet, according to the report of Wilson et al. (12) that the isolated cilium might play a role in the initiation of mitosis, the presence of an isolated cilium in this laminated cell further suggests that the nevic corpuscle is not merely an accompanying degenerated component of nevus cell nevus but the actively participating component of this kind of nevus cell nevus.

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K. Niizuma, M. D.
Department of Dermatology
Tokai University School of Medicine
Bohseidai, Isehara-city
Kanagawa-prefecture 259-11
Japan