AN ELECTRON MICROSCOPE STUDY OF THE BASAL CELL EPITHELIOMA*

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In a previous report (1), a pigmenting basal cell epithelioma was examined with both a light and electron microscope, the purpose being to determine the origin of melanin within this tumor. Since that report, the author has been reviewing the fine structure of basal cell epitheliomas. This report will serve to define in a more detailed manner, the ultrastructure of the solid, undifferentiated basal cell epithelioma and to point out several interesting features of this tumor. The morphology of the basal cell epithelioma as seen with the light microscope has been adequately commented on and will not be reviewed here (2–6).

METHODS

The three tumors studied were clinically and histologically characteristic of basal cell epitheliomas. The lesions were excised, immediately fixed in 1% buffered osmium tetroxide, embedded in Vestopal W and sectioned in the routine manner. The thin sections were studied by means of an RCA EMU-3F electron microscope.

FINE STRUCTURE

The tumor cells are monotonously similar to each other (Fig. 1). The nuclei are round and have a granular appearance. They have a double limiting membrane but the most common picture is that of a hazy, granular border rather than of being sharply limited by the double membrane. The nuclei are also large as compared to the cell volume. Nucleoli are seldom seen but when present have a worm-like structure with no limiting membrane.

In sharp contrast to the typical epidermal basal cell, the cytoplasm is granular and it is obvious that tonofilaments are at a minimum (Fig. 1). The filaments present are short, fine and have no apparent organization or localization. Melanin granules are also at a minimum but mitochondria are present in abundance (Figs. 1–4). They are similar to most mitochondria in having a double limiting membrane with the inner one being folded in upon itself to form shelves or crests which tend to go some distance across the organelle. The mitochondrial profiles assume a multiplicity of sizes (av. 6250 Å) and shapes ranging from round to filamentous. The mitochondrial sap is extremely osmiophilic (Figs. 1–4) which is in sharp contrast to the mitochondria of the epidermal basal cell. In some of the mitochondria two to three electron-dense granules (approx. 200 Å) are also present.

A peculiar morphologic pattern occurs alongside the nucleus in many of the tumor cells (Figs. 3&4). This complex is elongated and consists of numerous small, round vesicles, pear-shaped larger profiles and is surrounded by an array of short, fine filaments. It appears as though the cell is dividing in this region for often several desmosomes and a semblance of two closely applied cell membranes can be seen leading into the complex.

A Golgi apparatus is often seen but the endoplasmic reticulum is essentially absent. Multivesicular bodies (approx. 2500 Å, Fig. 1) are present. These have been seen in many other cell types but their significance is not as yet known. Several electron-dense bodies of unknown nature are also present (Fig. 1) in the tumor cells. These structures are round to oval (approx. 2000 Å × 3750 Å) and are composed either of many granules or of a lamellated material similar to myelin. Presumably these may be the cell lysosomes. The latter have a limiting membrane and are usually found near the cell membrane.

The cells of the tumor are closely applied to one another and the membranes occasionally show a high degree of convolution and folding (Fig. 1). Desmosomes (nodes of Bizzozero or "prickles") are present but are few in number. Tonofilaments anchor to their cytoplasmic surface. Contrary to the morphology in the epidermal basal cell, half-desmosomes are not

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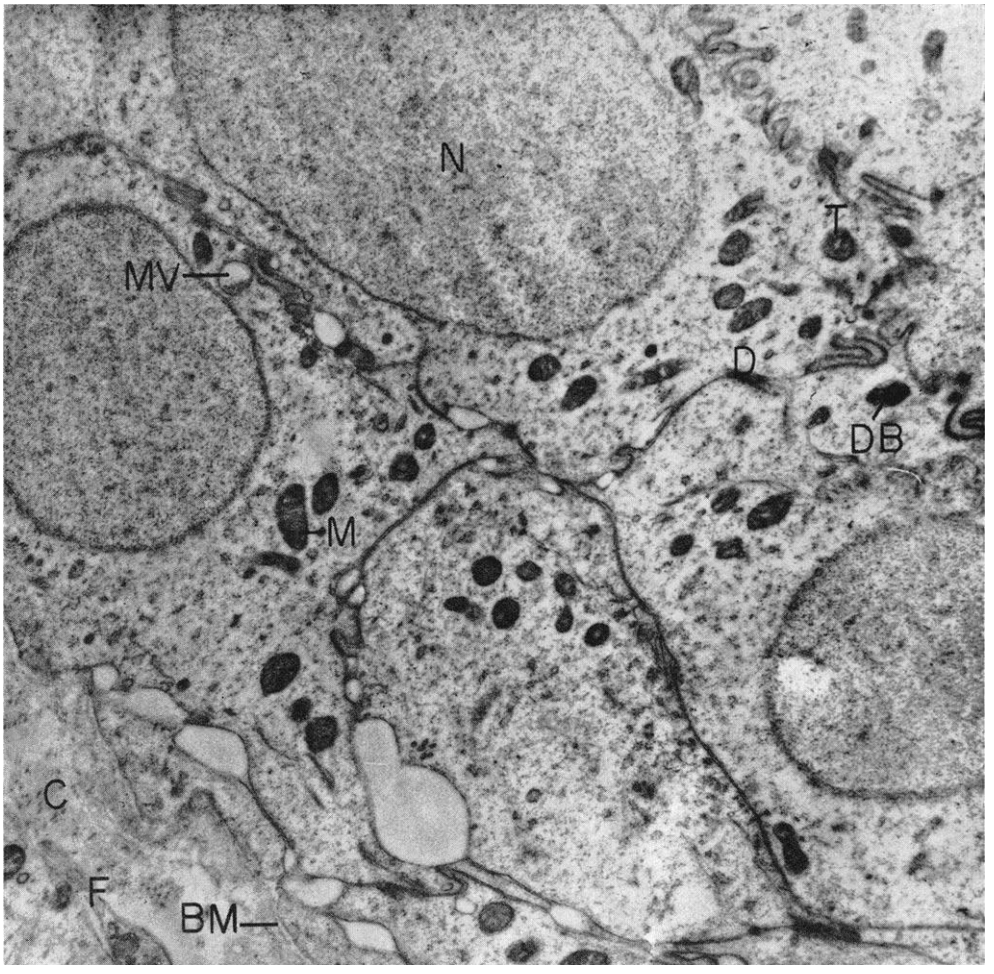

FIG. 1. The "palisading" region of a basal cell epithelioma. The cells are monotonously similar. Nuclei (N) are relatively large and round and the mitochondria (M) are very osmiophilic. Desmosomes (D) and tonofilaments (T) are seen but are few in number. A multivesicular-body (MV) as well as a dense-body (DB) are present. The basement membrane (BM) is present and intact. Collagen bundles (C) and fibroblasts (F) surround the tumor. × 16,170

found on the side of the cell facing the basement membrane.

Significantly, the tumor is separated from the dermis by a definite and unbroken basement membrane (approx. 400 Å below the epidermis, Figs. 1&2). The tissue on the dermal side of the membrane consists mainly of collagen bundles and fibroblasts. Inflammatory cells were few in number.

DISCUSSION

The cells of the basal cell epithelioma *differ* from the normal epidermal basal cell in the following ways: 1) the nuclear/cytoplasmic ratio is greater in the tumor; 2) filaments are at a minimum in the tumor but are in abundance in the normal basal cell; 3) the typical basal cell is oval and the cell membrane has numerous microvilli but lacks the intermittent extreme degree of convulution seen in the tumor cells; 4) desmosomes are plentiful in the epidermal basal cells but few in number in the tumor cells; 5) the endoplasmic reticulum is poorly developed in both, but more of it is seen in the epidermal basal cell; and lastly 6) there is an absence of half-desmosomes facing the basement membrane in the tumor.

Although the cells composing the basal cell

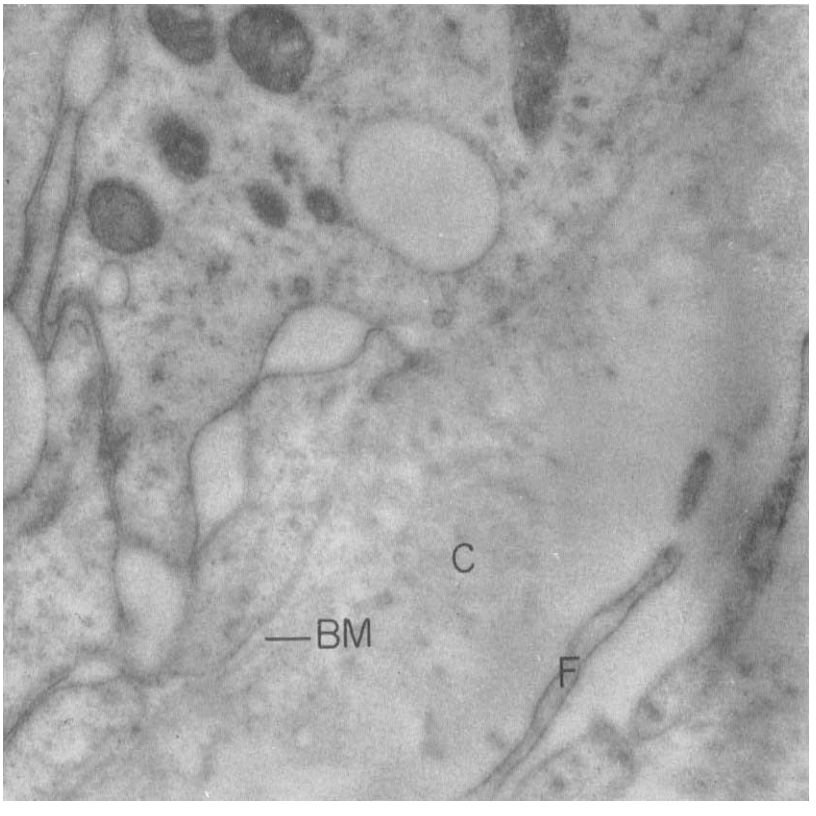

FIG. 2. A higher magnification of the tumor and its surrounding stroma. The basement membrane (BM) is shown and numerous collagen bundles (C) and fibroblasts (F) are located on its dermal side. × 57,024

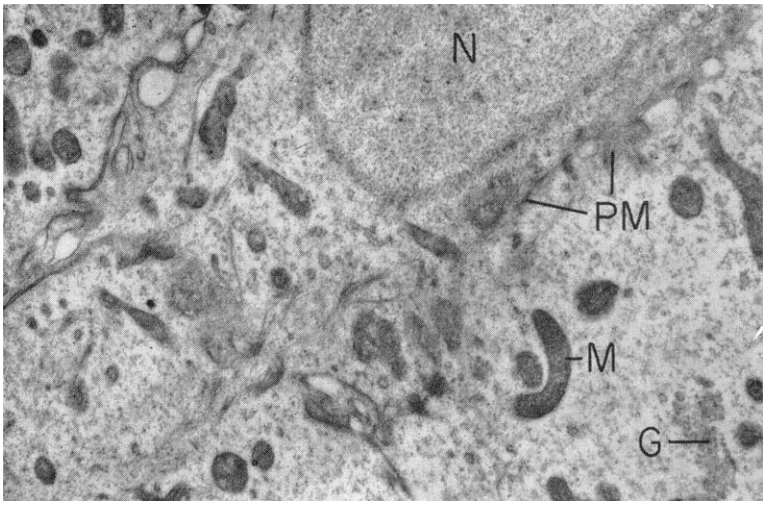

FIG. 3. Note the peculiar morphology (PM) alongside the tumor cell nucleus (N). Mitochondria (M) and a Golgi apparatus (G) are also seen. × 16,170

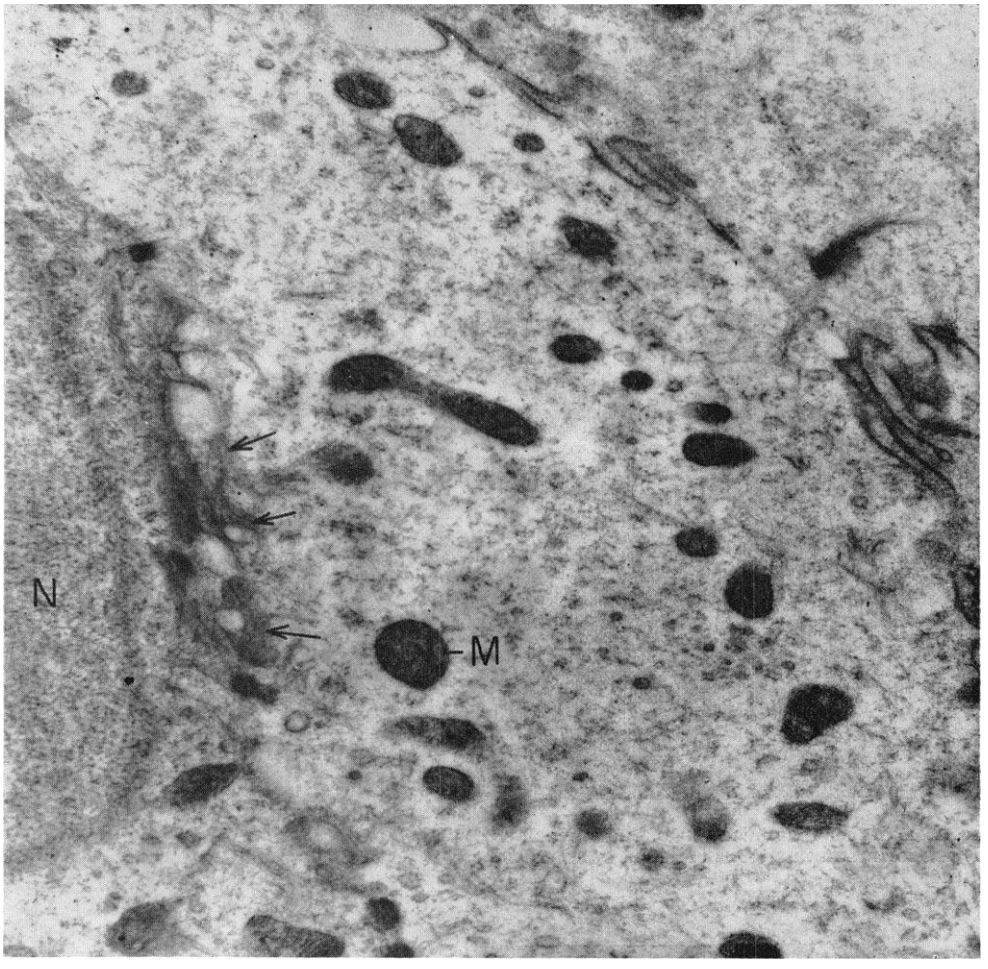

FIG. 4. A higher magnification showing the unusual pattern so often seen beside the tumor cell nucleus (N). The different sizes and shapes of mitochondria (M) are also demonstrated. × 25,344

epithelioma differ from the epidermal basal cell, they are quite similar to the cells of the undifferentiated matrix of the human hair follicle (7). They are *alike* in the following ways: 1) in both there is a large nuclear/cytoplasmic ratio; 2) filaments are at a minimum in both; 3) the cells of each are rounded and their membranes are interrupted at times by a high degree of folding; 4) in both desmosomes are few in number and intercellular gaps are often seen; and lastly 5) in both, the endoplasmic reticulum is minimal and the cytoplasm appears clear.

The cells of the basal cell tumor *differ* from the cells of the undifferentiated hair matrix and from the normal basal cell in the following ways: 1) in the tumor the mitochondrial shapes are more varied and the organelle sap more osmiophilic; 2) a peculiar morphologic pattern is present near the nucleus of the tumor cells; and finally 3) multivesicular structure and lysosomes are present in the tumor cells.

SUMMARY

The fine structure of solid, undifferentiated basal cell epitheliomas has been described and the morphologic differences and similarities between the tumor cells, the normal epidermal basal cells and the undifferentiated cells of the hair matrix were discussed.

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