FINE STRUCTURE OF THE THYMUS EPITHELIAL CELLS OF A MOUSE IN THE PERINATAL PERIOD

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In the thymus epithelium, varying in their composition, properties and biological effect humoral factors are synthesizing, on which the basic functional relations of the thymus are depending. This is the reason for the increased interest in the cytological peculiarities of the thymus epithelial cells as a basic element of the thymus epithelium and a predominant cell type among the nonlymphoid cells of the thymus. Because of the knowledge of the epithelial cell ultrastructure in an ontogenetic aspect being rather unsystematic and controversial (2, 7, 10), we undertook some electrono-microscopic investigations into these cells during the perinatal period of the conventional mouse life implying their interpretation from the thymic function point of view.

Material from mouse fetuses immediately before birth (17—18 days post-conception age), newborn — 12 hours old, and 7 days old have been treated according to the standardized electronomicroscopic investigation method (1).

Results

The thymus of the fetuses investigated by us consisted of two portions, each of them subdivided by partitions of connective tissue into smaller portions of thymus with welldefined cortex and medulla. Observable in each of the thymus portions are two basic cell types — lymphoid and epithelial. The epithelial cells are relatively bigger in size, rounded in shape, and interconnected by way of desmosomes. The subcapsular and the outermost cortical epithelial cells lie on a basal membrane. The epithelial cell nucleus is single, big in size, and pale. Observable in their cytoplasm are intermediary and thin cytofilaments, most of which organized into small bundles.

Within a focused study of epithelial cells from the various regions of the thymus, we distinguished three major types of epithelial cells — cortical, medullar, and "undifferentiated", possessing also some cytomorphological marks along with the general ones. The cortical epithelial cells are often elongated or stellar. The cytoplasm of some of these cells is taken up exclusively by organized into small bundles and longitudinally — oriented cytofilaments — epithelial cells of I (supporting) type, as we called them (Fig. 1). In other cortical epithelial cells, the cytofilaments are less numerous, at the expense of the remaining cytoplasmic organelles — we called them epithelial cells of II (productive) type. The cytoplasm of part of the epithelial cells of II type is optically more consistent and rich in polysomes and elements of granulated endoplasmatic reticulum, by reason of which we designate these cells as "dark epithelial cells" (Fig. 2a). The granulated endoplasmatic reticulum canals in some of them are moderately dilatated and filled with fine-flocculated content of moderate electronic density, the perinuclear space tends to extension, and one or several nucleoli are observable in the nucleus (Fig. 2b). Another

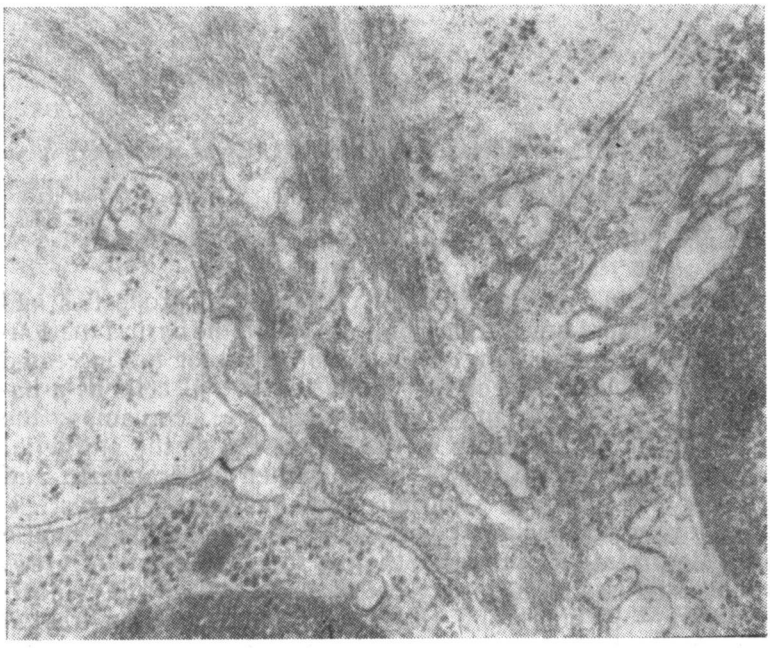

Fig. 1

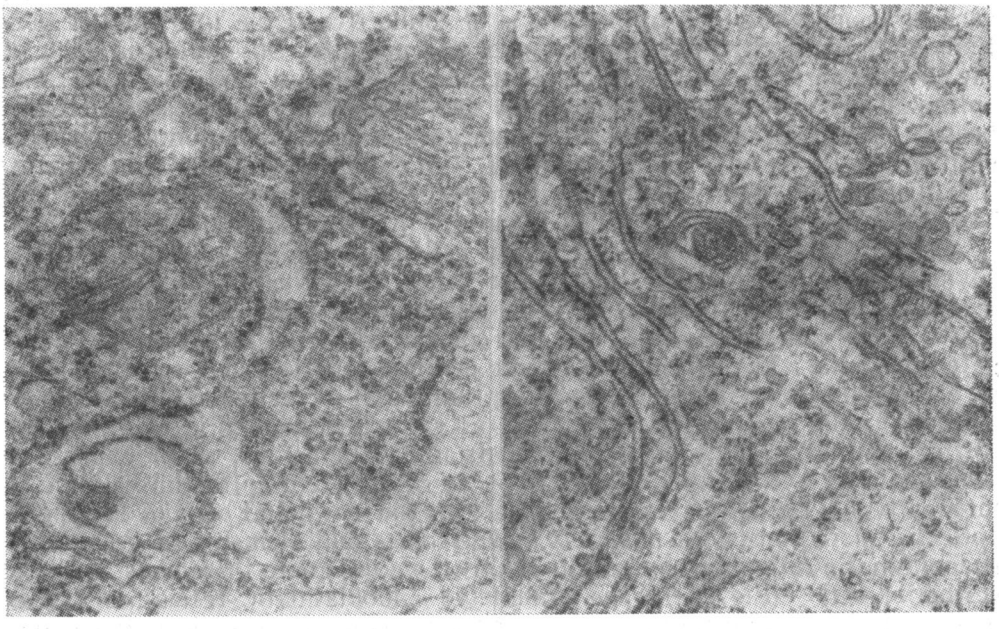

Fig. 2a

part of the cortical epithelial cells are of optically pale cytoplasm, with several mitochondria, granulated endoplasmatic reticulum canals, elements of moderately-developed Golgi apparatus, single consistent bodies, one or several typical membrano-organic vacuole cells designated by us as "pale" epi-

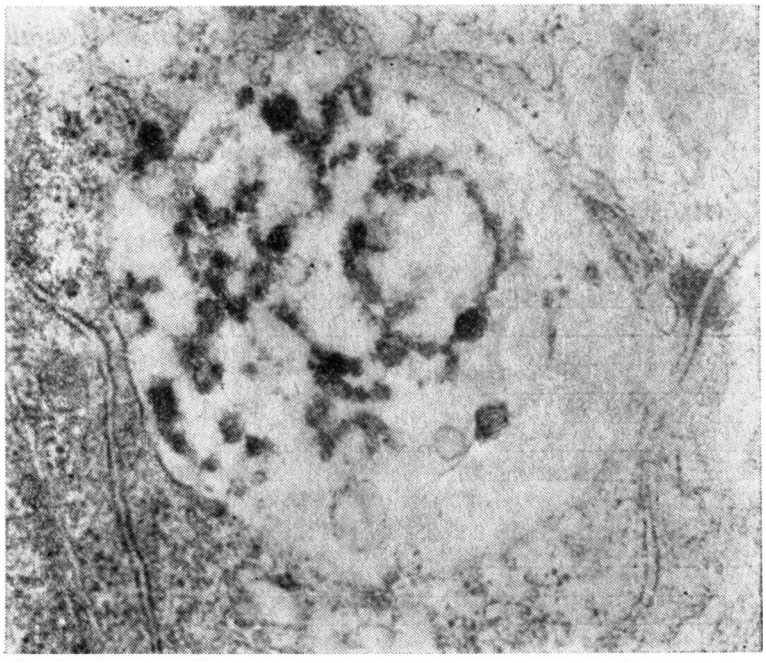

Fig. 3

thelial cells. Some of the typical vacuoles are optically void, whereas other are filled with fine-coarser-flocculated content of moderate electronic density (Fig. 3). Such vacuoles are neighbouring on vacuolized Golgi complex, of multiple cytofilaments, single large "coated" vesicles, and are located in proximity of the cell membrane. All medular epithelial cells are of optically pale cytoplasm. Distinguishable among them are medullar epithelial cells of a particular type, having nuclei located at one end of the cell and a relatively large number of vesicular and vacuolar structures concentrated opposite (Fig. 4). In the lumen of part of the vacuoles there are microfurcations jutting out, which make the respective cytoplasm region to look labyrinth-like. Observable inside the bigger vacuoles is a content of moderate electronic density. Both the granulated endoplasmatic reticulum and the Golgi apparatus are well-developed. Multiple cytofilament bundles penetrate between these vacuoles. Part of the thymic lobe epithelial cells are repititive cytomorhologically and can be found both in the thymic cortex and the medulla. Their nucleus is oval-shaped and surrounded by scarce cytoplasm, utterly poor in organelles.

The thymus epithelial cells of newborn mice are of the same electrono-microscopic characteristics as those already described in fetuses. In order to comprehend the occurence of the first more significant postnatal chan-

ges and their ultrastructure, we examined animals in an early postnatal age, i. e. 7-days old. No new epithelial cell types have been found in such animals, but there have been observed relations of immediate spatial proximity between epithelial and lymphoid cells. Particular attention deserve the cases of

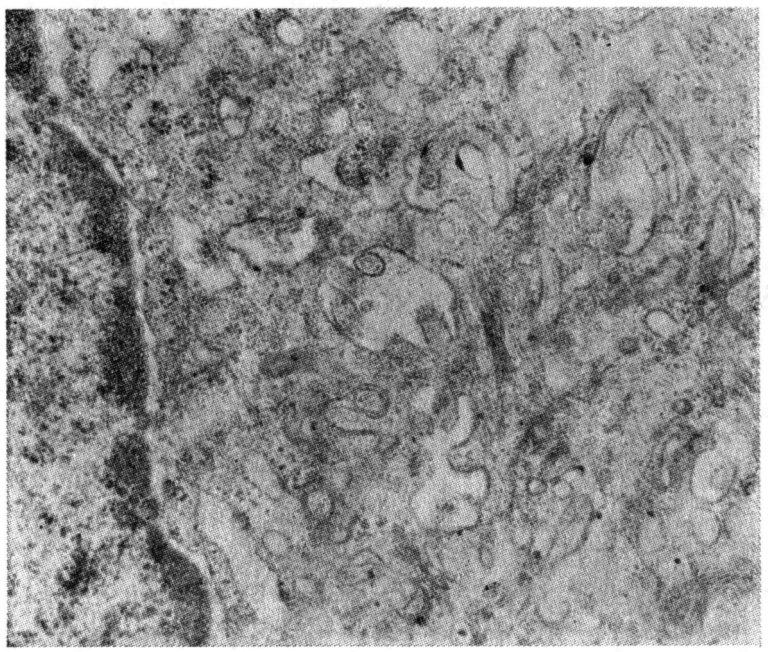

Fig. 4

ilntact lymphocytes being surrounded by cytoplasm of neighbouring epithelial cells. In certain areas, the cytolemes of the heterogeneous cells are sticking to one another and loose the distinctness of their outline.

Discussion

The electrono-microscopic observations on thymus of conventional mice during the perinatal period of their life made by us are in concordance with the literature data on the establishment of thymic cortex and medulla between the 15th and 19th day of prenatal development of various breeds of mice, and on the preservation of the ultrastructural features in newborn animals (3, 6, 10, 11). The cytomorphological heterogeneity of the cortical epithelial cells described corresponds to the known from other investigations (1) heterogeneity of the same cells in grown animals. At the same time, we observed only one of the several known cell types (8) from the intermediate and medular thymic area of grown animals. We regard these differences as resulting from the differentiation of the cortical epithelial cells going before that of the medullar cells during ontogenesis. Our results are in support of the standpoint existing in literature that the earliest among the medullar cells are differentiated the polarised medullar epithelial cells, also known as hypertrophic cells (5, 10).

But whereas according to Clark, S., 1966 these cells can only be found during the first week of the conventional mice life, we observed these same cells even prenatally. It seems that the described by us differentiated epithelial cells of productive type — some cortical epithelial cells of II type and the polarised medullar epithelial cells — even before birth in the thymic cortex and medulla of conventional mice make it possible for the synthesis of thymic humoral factors to take place as early as in the prenatal stage. At the same time notable is the absence of the known in grown animals variety of autophagosomes, heterophagosomes and telolisosomes in the cortical epithelial cells due most probably to the lisosomal apparatus being not yet engaged in the basic functional relations of these cells. These data of ours are in concordance with similar morphological investigations into the thymus of human fetuses (4) and chichen embryo (12) as well as with the established presence of a lymphocyto-stimulating factor in the thymus of two-day-old mice (9).

In 7-day-old conventional mice examinated by us we found that the cytomorphological heterogeneity of the thymus epithelial cells known from the perinatal period remained preserved. These data of ours are not in concordance with the differentiation described in rat thymus of four types of epithelial cells against the "undifferentiated" ones occuring not until the eight hour after birth (2). In our opinion, this has to do either with some species-specific peculiarities in the cell differentiation process or with insufficient knowledge of the prenatal ultrastructural characterization of the epithelial cells. The described by us subtle interrelations of epithelial and lymphoid cells are, most probably, a morphological prerequisite for the functional interrelation of these cells.

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ТОНКАЯ СТРУКТУРА ЭПИТЕЛИАЛЬНЫХ КЛЕТОК ВИЛОЧКОВОЙ ЖЕЛЕЗЫ МЫШИ В ПЕРИНАТАЛЬНОМ ПЕРИОДЕ

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РЕЗЮМЕ

Изучены цитологические особености эпителиальных клеток вилочковой железы конвенциональных мышей в течение перинатального периода их индивидуального развития. В вилочковой железе мышей фетусов непосредственно до рождения (17ый—18ый день после концепции) возможно разграничить кортикалные, медулярные и «недиффе-

ренцированные» эпителиалтные клетки, обладающие характерной ультраструктурой. Отмечены два типа кортикальных эпителиальных клеток с различной цитологической характеристикой. У новорожденных мышей (12 часов после рождения) и у 7-дневных мышей эпителиальные клетки вилочковой железы сохраняют свои отличительные цитологические особенности; более существенные изменения наблюдались только в форме клеток и в характеристикие их вакуолярного аппарата.

Полученные ультраструктурные данные рассматриваются в связи с возрастными особенностями функциональной активности эпителиальных клеток вилочковой железы.