# STRUCTURAL TRANSFORMATIONS OF THE VASCULAR SYSTEM OF THE CONNECTIVE-TISSUE BASIS OF THE SKIN

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The structural and functional features of the stratified squamous epithelium covering the skin have been described in adequate detail in publications devoted to the study of the two main components of the skin — its connective-tissue basis and the epidermis [2, 6, 7]. So far as the connective-tissue basis of the skin is concerned, however, information about its histological structure is limited to ideas of the coarse fibrous tissue containing numerous collagen and elastic fibers, a few blood vessels, and solitary mast cells, fibroblasts, macrophages, and so on, distributed mainly in their surroundings.

In the course of an electron-microscopic autoradiographic study of the vascular system of the basis of the skin the writers came across an unknown and still incompletely understood phenomenon, which is described below.

## EXPERIMENTAL METHOD

Pieces of skin taken from six patients aged between 7 and 39 years, undergoing operations for congenital heart defects or diseases of the abdominal organs, i.e , diseases not accompanied by skin lesions, were investigated.

Material for histological investigation was embedded in paraffin wax and sections were strained with hematoxylin and eosin, with picrofuchsine by Van Gieson's method, and with toluidine blue. For electron-autoradiographic investigation pieces measuring 1 $mm^3$ in volume were excised and incubated at 37-38°C in medium 199 containing 100 μCi/ml of $^3$H-uridine (specific activity 26.0 Ci/mmole) or 20 μCi/ml of $^3$H-thymidine (21.6 Ci/mmole) for 1.5 h. At the end of incubation the material was washed with cold phosphate buffer, pH 7.4, to remove unincorporated precursor, fixed with a 2.5% solution of glutaraldehyde and a 1% solution of $OsO_4$, and embedded in Epon. Semithin sections were first studied by light-microscopic autoradiography. Depending on the results of this analysis, areas for ultramicrotomy were selected in the semithin sections. Electron-microscopic autoradiographs were prepared by the method described previously [3] and examined in the IEM-100B electron microscope.

## EXPERIMENTAL RESULTS

Data obtained by electron-microscopic autoradiography, showing that cells actively synthesizing RNA and DNA, i.e., in the most viable state, are distributed in the connective-tissue formations chiefly in the walls of the small blood vessels and in their immediate vicinity, were published previously by the writers [1, 4, 5].

In the present investigation, a study of serial electron-microscopic sections showed that besides vessels of the arteriole and venule types, showing the typical structure in transverse section (Fig. 1a), there are also others which have the normal structure in some sections, whereas in others their walls gradually become thinner in a particular area, after which their continuity is disturbed, and cells which previously formed the vessel wall lie in a semicircle and gradually lose their connections with each other (Fig. 1b, c). The presence of erythro-

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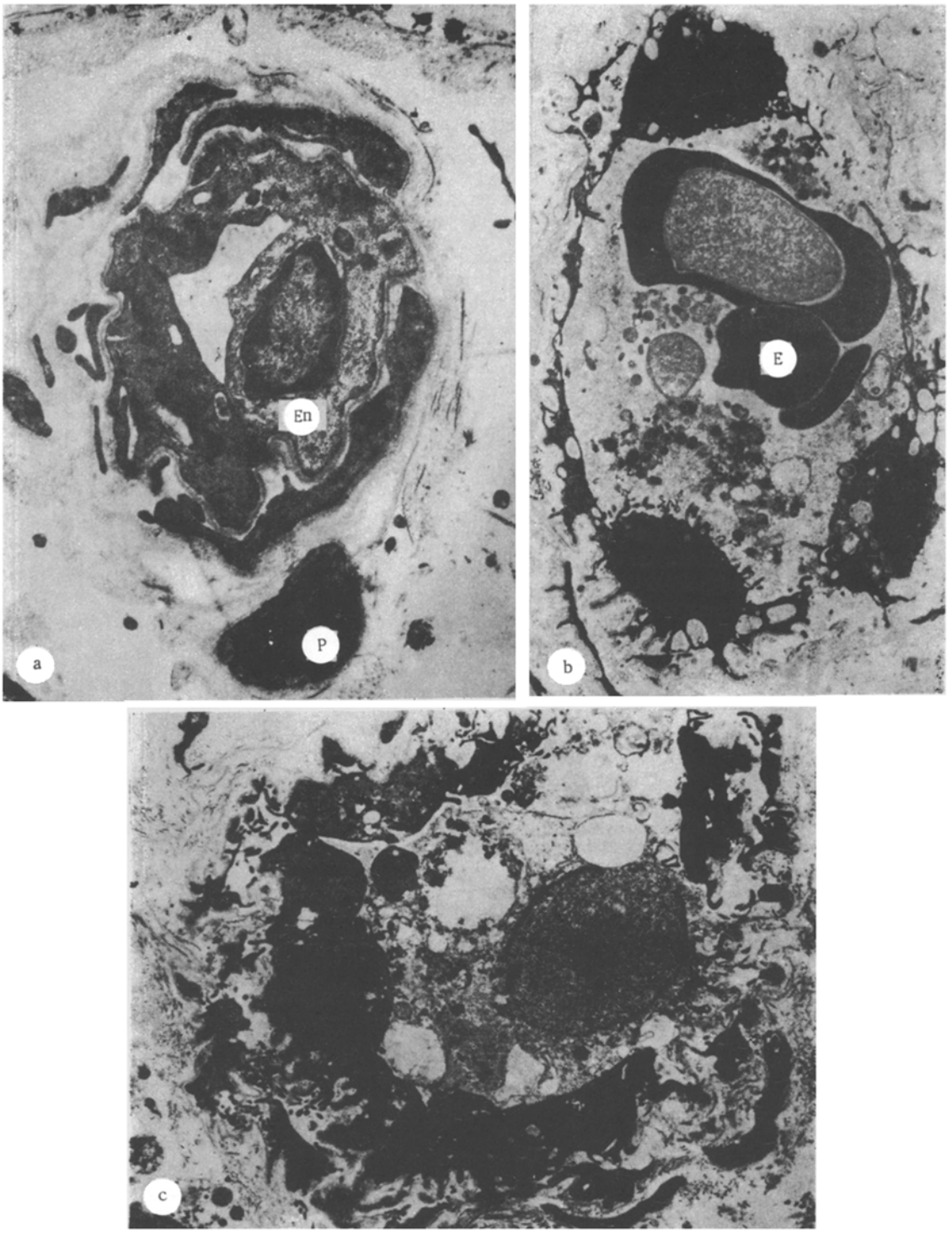


Fig. 1. Capillaries of the connective-tissue basis of the skin (electron microscopy): a) a capillary in the skin has its normal structure. En) endotheliocyte, P) pericyte. 3000×; b, c) capillary wall is tapering and its integrity is disturbed in places. Lumen of vessel contains erythrocytes (E), debris, and granules of disintegrating cells. 4000×.

cytes in their lumen is evidence that these are blood vessels — arterioles and venules. Cells labeled with $^{3}$H-uridine and $^{3}$H-thymidine are usually endotheliocytes and pericytes. The lumen of these modified vessels is filled with bundles of fine fibrous tissue.

There are adequate grounds for considering that the structural transformations we found in the vessels are a physiological phenomenon, although it is difficult as yet to give a pre-

cise explanation. One possible suggestion is that the changes described in the very small blood vessels of the skin are a manifestation of the physiological regeneration of the basis of the skin. Whereas the principles of renewal of the epidermis have been studied in adequate detail, little is known about the physiological regeneration of the connective-tissue basis of the skin. It is considered to be undertaken by fibroblasts producing collagen fibers. On the question of the origin of the fibroblasts themselves, the sources of their continuous renewal and replenishment of their composition – relations between their state such as between fibroblast and fibrocyte, much remains in dispute. It can be postulated that one mechanism of physiological regeneration of the basis of the skin is that, as a result of the transformations of the small vessels described above, pericytes leave the vessel walls and give rise to new populations of fibroblasts. In other words, it is suggested that the small vessels of the basis of the skin, which are continually "dying" and being reformed, constitute the main source and inducer of physiological regeneration of the cells and fibrous structures of the basis of the skin.

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# CHANGES IN SYNAPSES IN SOME CORTICAL AND DEEP BRAIN FORMATIONS IN OLD RATS


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A decrease in the number of synaptic junctions (SJ) has been demonstrated in the CNS of man and animals during aging [7, 9, 11]. The decrease in the number of synapses of different types is not uniform [7, 10, 14]. Numerous light-optical investigations have shown substantial changes in the postsynaptic components of synapses, namely dendrites and spines, which play an important role in the primary processing of information reaching the neuron and in the synaptic mechanisms of brain activity, during aging. There have been only isolated studies of age changes in the ultrastructure of interneuronal connections. In old animals a reduction in the density and total length of SJ [9], changes in the pre- and postsynaptic components of the synapses or even degeneration of dendritic and axonal profiles [3, 4, 8] have been observed, although other data have shown the absence of any age differences in synapse ultrastructure [10].

The aim of this investigation was to study the ultrastructure of synapses in different regions of the cortex and deep brain formations of old rats.


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