SCHOLASTIC:
Journal of Natural and Medical Education
Volume 2 Issue 2, Year 2023 ISSN: 2835-303X
https://univerpubl.com/index.php/scholastic

Histological Changes of Stromal Cells in Adverse Environmental Conditions

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Article Information

Received: December 09, 2022
Accepted: January 10, 2023
Published: February 11, 2023

Keywords: *immunology, immunocompetent cells - T-, B-lymphocytes*

ABSTRACT

Electron-microscopic studies of the thymus of white laboratory rats under unfavorable environmental conditions established ultrastructural features of stromal cells of different zones of the thymus. In the cortical zones, along with classical epitheliоreticulocytes, dendritic and monocyte-like cells are predominant, interdigitating cells are localized mainly in the medullary zones. Macrophages and monocyte-like cells are frequent in the corticomedullary zones.

Relevance: In recent years, due to the intensive development of theoretical and applied immunology, ideas about the structural foundations of immunity have expanded significantly. The cellular and subcellular foundations of immunity and the main mechanisms of cooperative interactions of immunocompetent cells - T-, B-lymphocytes and macrophages (A - cells), due to which the body's immune response is provided (1,2,3,4,14,15).

Until now, the structural and functional bases of the reaction of the immune organs under various exogenous and endogenous influences have not been sufficiently clarified. The works available in this regard are mainly devoted to the quantitative characterization of one or another organ of this system and they are performed mainly in cell suspensions in vitro and therefore cannot reflect the essence of intercellular interactions at the tissue, organ and interorgan levels (5,6,7,8,12).

Meanwhile, the study of the structural and functional foundations of adaptive changes in the organs of the immune system is one of the urgent problems of modern medicine and biology in general. The choice of the model was to a certain extent determined by the need to conduct such studies due to the relevance of the impact of adverse environmental factors in our region (9,10,11).

The dry hot climate of the Bukhara region was obtained as negative ecofactors.

Material and methods: The experiments were carried out on white sexually mature outbred male rats with an initial weight of 150-170 grams, which were on the usual laboratory diet. Prior to the start of the experiments, 10 rats under ether anesthesia, under sterile conditions, underwent

laparotomy for the purpose of macroscopic examination of all internal organs and lymphoid formations of the gastrointestinal tract. These studies have shown that almost all organs of the chest and abdominal cavities are in normal condition.

The experimental animals were divided into two groups. The first group consisted of 42 intact rats. The second group is experimental (118 rats).

They were transferred for 1 hour to the conditions of exposure to the dry hot climate of the Bukhara region by keeping them outdoors when exposed to sunlight. Moreover, all experiments were carried out in the summer season. Temperature regime $+39^0$ $+43^0$C. They were under normal laboratory conditions.

Experimental and control animals were slaughtered under ether anesthesia, by decapitation, on an empty stomach, 3,6,12,24 hours, 3,5,7,14,21 days after temperature exposure.

Pieces of thymus served as material for research.

For electron microscopic studies, thymus pieces were fixed in 2.5% glutaraldehyde solution at 4°C for 40 minutes, followed by additional fixation in 1% osmic acid solution for 1 hour at 4°C. The materials were dehydrated in alcohols of increasing concentration, poured into araldite and epon-812. Ultrathin sections were obtained after taking and appropriate coloring of targeted semi-thin sections (E. Enkuzes, F. Ehrenpreis 1980) on an ultramicrotome from LKB (Sweden). Contrasting was carried out with uranyl-acetate and lead citrate, after which the sections were viewed in a JEM-100S electron microscope (Jeol, Japan).

Research results and discussion:

Comprehensive studies of the thymus glandin the dynamics of the experiments made it possible to identify certain periods of these changes:

- ✓ period of early changes - up to 3 days of experiments;
- ✓ the period of pronounced structural and functional rearrangements of the organ - 3-7 days of the study;
- ✓ period of long-term results - 14 - 21 days of experiments.

Each of these periods is characterized by its structural and functional features.

Ultrastructural studies of the thymus in the period of early changes revealed certain rearrangements of the submicroscopic organization of cells in different zones of the thymus. In the cortical zone, reticuloepithelial cells are in contact with many medium and small lymphocytes. Moreover, among epithelioreticulocytes, monocyte-like (Fig. 1) and dendritic cells (Fig. 2) are often detected. In the corticomedullary zone of the thymus, the hemocapillaries are dilated, there are many blood cells in the lumen, mainly lymphocytes of various varieties. Migration of lymphocytes through the wall of hemocapillaries is often noted. The perivascular spaces are also enlarged, they contain leukocytes with small and large processes, most likely indicating their migration. In the medullary zone, cells are

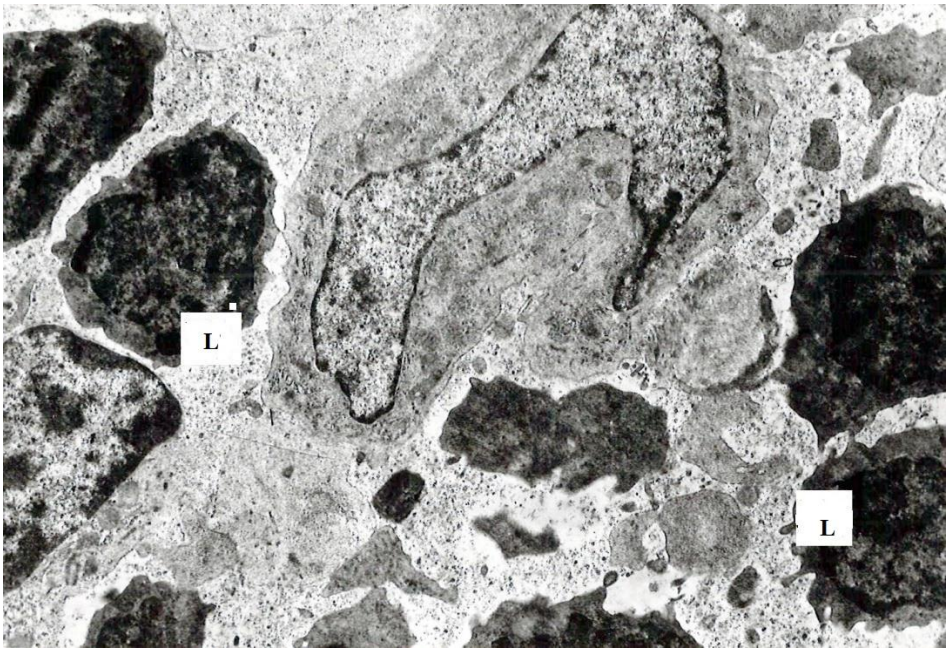

Fig.1 Thymus. 3-day experiment. Ultrastructure of monocyte-like cells in the cortical zone of the thymic lobule. SW. 3500.

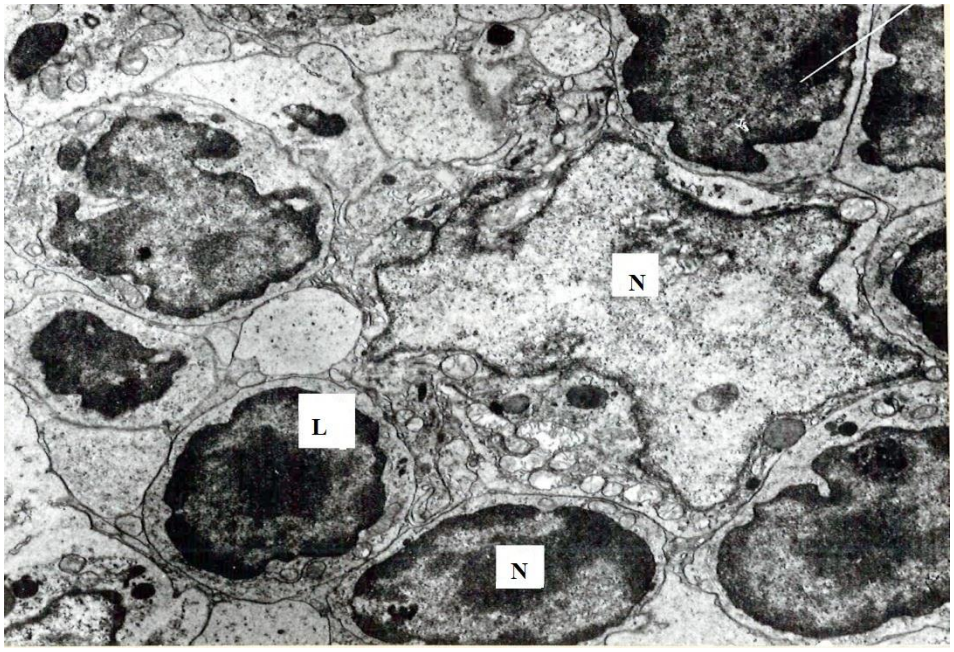

Fig.2 Thymus. 3-day experiment. Dendritic cell in contact with lymphocytes of the cortical zone. SW. 4200.

often determined; in their submicroscopic organization, they correspond to interdigitating cells. Numerous processes of which penetrate between the lymphocytes of the medullary zone and contact each other.

The most pronounced quantitative and qualitative changes in various structural and functional zones of the thymus gland are observed on days 5–7 of the experiment.

Epithelioreticulocytes of almost all structural and functional zones are hypertrophied, their nucleus is irregular in shape due to the appearance of numerous invaginations of the nuclear membrane. Their wide cytoplasm has vesicles with a fibrillar matrix, many mitochondria, lysosomes and profiles of the endoplasmic reticulum, often in contact with macrophages.

Conclusions:

1. Stromal elements of the thymus of white laboratory rats are represented by ordinary epithelioreticulocytes, interdigitating and dendritic cells, monocyte-like cells and macrophages.
2. The composition of stromal cells has certain differences in the zones of thymic lobules: in the cortical zones, dendritic epithelioreticulocytes, monocyte-like cells prevail. Interdigitating cells are part of the medullary zones. The cortico-medullary zones occupy a middle position in the composition of the stroma.

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