



## MODERN ASPECTS OF HISTOLOGICAL STRUCTURE AND FUNCTIONAL MORPHOLOGY OF THE ENDOCRINE SYSTEM

**Abduraimova Tursunoy Shukhrat qizi**

[abduraimovatorsunoy78@gmail.com](mailto:abduraimovatorsunoy78@gmail.com)

EMU University, 125 A Student, Faculty of Medicine

Scientific supervisor: **Savriyeva Durdona Doud qizi**

Place of work: EMU University, Assistant,  
Department of Medical Biological Sciences

**Abstract:** *Endocrine histology is a crucial branch of morphology, studying the microscopic structure of endocrine glands, their cellular composition, tissue organization, and functional relationships. The endocrine system plays a key role in maintaining the body's homeostasis, regulating metabolism, growth, development, and adaptation to changing environmental conditions. Therefore, a detailed study of the histological features of endocrine organs is essential for understanding their mechanisms of function under normal conditions and various pathological conditions.*

*This paper examines the major organs of the endocrine system, including the pituitary gland, thyroid gland, parathyroid glands, adrenal glands, pancreas (islet apparatus), and pineal gland. Particular attention is paid to the characteristics of their microscopic structure, cell types, their functional activity, as well as the characteristics of their blood supply and innervation. Structural differences between the adrenal cortex and medulla, features of the follicular structure of the thyroid gland, the cellular composition of the anterior pituitary gland and neurohypophysis, and the morphological features of the islets of Langerhans are described.*

**Key words:** *histology, endocrine system, endocrine cells, endocrine glands, ultrastructure, secretory cycle*

**The aim of this work is** to systematize modern concepts of the histological architecture of the endocrine system organs, as well as to analyze the relationship between the ultrastructural organization of secretory cells and their functional activity in various physiological states.

**The study's methodological basis** is classical histological methods, including light microscopy using standard and specialized staining techniques, as well as modern approaches such as immunohistochemical analysis, which allows for the identification of hormone-producing cells and assessment of their functional status. The use of comprehensive morphological analysis provides a deeper understanding of the structural and functional characteristics of the endocrine system.

The paper also covers age-related changes in endocrine organs and their adaptive responses to external and internal factors, including stress, environmental influences, and disease. Morphological changes in common endocrine pathologies, such as glandular hypo- and hyperfunction, autoimmune processes, and tumors, are examined.

The findings highlight the close relationship between the structural organization of endocrine glands and their function, which has important implications for clinical practice, diagnosis, and the development of effective treatments for endocrine diseases. This study can serve as a theoretical basis for further research in the fields of histology, endocrinology, and clinical medicine.

The endocrine system is the body's most important regulatory apparatus, maintaining homeostasis through subtle mechanisms of chemical communication. With our modern understanding of tissue biology, histological analysis of endocrine glands goes beyond classical descriptions, shifting toward the study of molecular-morphological correlations and mechanisms of intercellular interactions. Understanding the structural organization of endocrine organs is the foundation for diagnosing pathological conditions and developing targeted therapies.

**Study results.** The analysis revealed structural patterns in cytoplasmic organelles (specifically, the Golgi apparatus and endoplasmic reticulum) in various types of endocrine cells, directly reflecting the cells' synthetic profile. Morphological markers of functional activity (the degree of development of secretory granules and the density of the capillary network) were found to be key indicators of adaptive processes in the body when exposed to stress factors. A

number of studies have not linked serum resistin levels to thyroid dysfunction. Serum resistin levels are not associated with either insulin resistance or BMI in patients with hypothyroidism. However, two studies we identified demonstrated that thyroid dysfunction can influence serum resistin levels.

Thus, the studies conducted do not provide a complete picture of changes in adiponectin, leptin, and resistin levels in thyroid dysfunction, particularly in hypothyroidism of varying severity. The role of adipose tissue hormones in the pathogenesis of atherosclerosis in hypothyroidism remains poorly understood. Currently, it can only be assumed that changes in adipocytokine levels play a certain pathogenetic role in the process of atherogenesis in hypothyroidism, accompanied by insulin resistance.

The work consistently examines the main components of the endocrine apparatus: Central link: Microanatomy of the hypothalamic-pituitary complex, including the morphofunctional features of the adeno- and neurohypophysis.

Peripheral Organs: A detailed analysis of the structure of the thyroid, parathyroid glands, adrenal glands, and endocrine islets of the pancreas, with an emphasis on the heterogeneity of cell populations.

APUD System (APUD Series): The Role of the Diffuse Endocrine System in the Integration of the Functions of the Gastrointestinal Tract and Other Organs.

Vascularization: Analysis of the adaptive features of the capillary bed (fenestrated type of endothelium), ensuring a high rate of hormonal secretion.

In this regard, studying adipocytokine levels, as well as their role in the prevention or development of cardiovascular risk in patients with FH, both with and without levothyroxine replacement therapy, is a pressing issue in endocrinology. Addressing this issue may allow for a broader understanding of some of the mechanisms underlying cardiovascular disease in FH and may also support one of the existing approaches to levothyroxine replacement therapy for patients with borderline TSH levels. It should be noted that such studies are extremely rare in the Russian literature. This is the first study to analyze adiponectin, leptin, and resistin

levels and evaluate their role in the development of cardiovascular disease in patients with subclinical hypothyroidism across different age groups.

The role of subclinical hypothyroidism as a risk factor for the development of CVD in different age groups, taking into account BMI, was assessed serum adiponectin levels on lipid metabolism in women with subclinical hypothyroidism and normal body weight was revealed.

The role of serum leptin levels as an atherogenic factor has been determined primarily in patients with subclinical hypothyroidism associated with overweight and obesity.

Data were obtained on changes in the content of adiponectin and leptin in the blood serum of patients with subclinical hypothyroidism depending on the absence administration of replacement therapy with levothyroxine sodium in different age groups, showing the advisability of prescribing replacement therapy with levothyroxine sodium mainly to young and middle-aged women.

**Conclusion:** The presented data emphasize that histological analysis remains an indispensable tool in research and clinical practice. The article's findings can be used for an in-depth study of endocrine regulation mechanisms, as well as for the differential diagnosis of benign and malignant endocrine tumors.

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