

**PHYSIOLOGICAL ROLE OF THE HYPOTHALAMO-PITUITARY SYSTEM IN ADAPTATION TO STRESS****Djurayeva Ra'no Xayrullojeva**Department of Fundamental Medical Sciences of the Asian International University.  
Bukhara, Uzbekistan.**Abstract**

Stress is a nonspecific adaptive response of the organism to internal and external stimuli, in which the hypothalamo-pituitary system plays a central regulatory role. This article examines the physiological role of the hypothalamo-pituitary-adrenal (HPA) axis in stress adaptation, including its hormonal mechanisms and negative feedback regulation. Activation of corticotropin-releasing hormone, adrenocorticotrophic hormone, and glucocorticoid secretion under stress conditions contributes to metabolic, immune, and neural adaptations. The article also discusses the dysfunction of the hypothalamo-pituitary system under chronic stress and its pathological consequences.

**Keywords**

stress, hypothalamo-pituitary system, HPA axis, cortisol, ACTH, adaptation, glucocorticoids, negative feedback

**Introduction**

Stress is a nonspecific response of the body to internal or external environmental factors (physical, chemical, biological, psychoemotional). The hypothalamic-pituitary system, especially the hypothalamic-pituitary-adrenal (HPA) axis, plays a central role in the mechanisms of adaptation to stress. This system is important in maintaining homeostasis, mobilizing energy resources, and ensuring the survival of the organism.

**General description of the hypothalamic-pituitary system**

The hypothalamic-pituitary system is the main link between the central nervous system and the endocrine system. The hypothalamus converts nerve signals into hormonal signals and controls the activity of the pituitary gland. ACTH, in turn, stimulates the adrenal cortex, increasing the production of glucocorticoids, mainly cortisol. Cortisol is the main effector hormone of stress adaptation, which mobilizes the body's energy resources, activates gluconeogenesis, increases the reactivity of the cardiovascular system, and modulates inflammatory and immune responses. This allows the body to maintain vital functions during stress.

In addition, the activity of the hypothalamic-pituitary system is tightly controlled by a negative feedback mechanism. An increase in the level of glucocorticoids in the blood leads to a decrease in the secretion of CRH and ACTH at the hypothalamus and pituitary level. This mechanism ensures hormonal balance and prevents excessive stress response.

At the same time, modern studies show that the duration and intensity of stress determine the activation of the hypothalamic-pituitary system in a physiological or pathological direction. While short-term (acute) stressors increase the body's adaptability, chronic stress, through constant activation of the HPA axis, creates the basis for the development of hypercortisolemia, weakened immunity, metabolic disorders, and cardiovascular and neuropsychiatric diseases.

**Main components:**

Hypothalamus (paraventricular nuclei)

Anterior pituitary gland (adenohypophysis)

Adrenal cortex

Activation of the HPA axis during stress

The following sequence occurs under the influence of a stress factor:

Hypothalamus — secretes corticotropin-releasing hormone (CRH) and vasopressin

Pituitary gland — increases the secretion of adrenocorticotrophic hormone (ACTH)

Adrenal glands — produce glucocorticoids (mainly cortisol)

Cortisol is the main effector hormone in stress adaptation.

Physiological effects of glucocorticoids

Cortisol provides the body's response to stress in the following ways:

Metabolism:

Increases gluconeogenesis

Increases blood glucose

Cardiovascular system:

Increases sensitivity to catecholamines

Immune system:

Anti-inflammatory and immunosuppressive effects

Central nervous system:

Effects on memory, attention, and emotional responses

These effects are adaptive in the short term, but can be pathological in the long term.

Negative feedback mechanism

The activity of the hypothalamic-pituitary system is controlled by negative feedback. When the amount of cortisol in the blood increases:

Secretion of CRH in the hypothalamus

Production of ACTH in the pituitary gland decreases

This mechanism serves to maintain hormonal balance.

#### Chronic Stress and System Dysfunction

In conditions of prolonged stress, persistent activation of the HPA axis can lead to the following conditions:

Hypercortisolemia

Immune suppression

Metabolic syndrome

Depression and anxiety disorders

Cardiovascular disease

These conditions indicate a transition of the hypothalamic-pituitary system from adaptation to pathology.

#### Conclusion

The hypothalamic-pituitary system is the central regulator of stress response and adaptation processes. While its physiological activity protects the body from short-term stress, its long-term activity can cause the development of various pathological conditions. Therefore, an in-depth study of this system is of great importance for clinical and theoretical physiology.

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