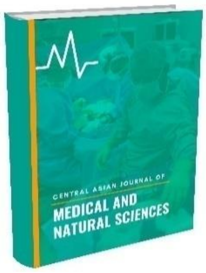
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 04 Issue: 02 | Mar-Apr 2023 ISSN: 2660-4159

http://cajmns. centralasianstudies. org

The Role of Hormonal Regulation in the Maintenance of Homeostasis

1. **Ukhtamova Mushtariybonu**
2. **Mardieva Ziyoda**
3. **Saidmurodov Mahmudali**

Received 2nd Jan 2023,
Accepted 3rd Feb 2023,
Online 29th Mar 2023

[1,2,3] Samarkand State Medical University

Abstract: Of all biologically active compounds and substrates taking part in regulation of biochemical processes and functions, a special role belongs to hormones. Hormones are organic substances that are formed in tissues of one type (endocrine or endocrine glands), enter the bloodstream, are transported through the bloodstream to tissues of another type (target tissues), where they exert their biological effect (i.e. regulate metabolism, behavior and physiological functions of the body, as well as cell growth, division and differentiation).

Key words: Hormones, cell division and differentiation, CNS, hypothalamus.

Introduction. Hormonal regulation is a general term for the regulatory effect of various hormones on body functions. Hormonal regulation emerged at a certain stage of evolution, earlier than neuromodulation, and serves as a link between the central nervous system and tissues. Hormonal regulation plays an important role in homeostasis maintenance and adaptation of organism to external and internal environment changes. It is performed by changing the secretion of hormones in response to external and internal influences, which can be carried out from the CNS to the hypothalamus (releasing factors) to the pituitary gland (triploid hormones) to the peripheral endocrine glands (hormones) to organs and tissues (see hypothalamic-pituitary system).

Results: Since hormonal regulation as a whole results from the influence of various hormones, individual physiological actions are determined by the action of these hormones; hormonal regulation affects all levels of organization of the living system; hormonal regulation is a physiologically active hormone responsible for the development of the organism. Depending on the specificity of the hormonal action, it can be relatively specific, such as selective regulation by aldosterone of sodium and potassium transport through renal epithelial structures, or it can be extensive, such as regulation of oxidative processes, differentiation processes, growth and development. In any case, however, the specific objects of hormonal regulation are the chemical reactions of living organisms, and this is of paramount theoretical and practical interest.

The most studied mechanism of hormonal regulation is the effect of hormones on protein biosynthesis. Hormonal influence on the rate of protein biosynthesis underlies the control of such processes as growth, development, tissue differentiation, tissue protein synthesis, and follicle maturation. Since all chemical reactions in the body are catalyzed by enzymes, hormonal regulation is most clearly represented by the influence of hormones on enzyme synthesis. The most studied hormonal regulation is the synthesis of two enzymes of amino acid metabolism, tryptophan (tryptophan oxygenase or tryptophan pyrrolase) and tyrosine (tyrosine aminotransferase). Glucocorticoids have been found to significantly increase the rate of synthesis of these enzymes in animals and humans. Similar data have been obtained on the effects of other hormones on enzymes, and there is often an antagonistic relationship between the hormones. For example, there is evidence that glucocorticoids and insulin have opposite effects, with glucocorticoids inhibiting glucose breakdown in tissues and insulin increasing glucose breakdown. This fact can be explained by the opposite effect of these hormones, where data show that hormones increase the activity of certain enzymes without changing the amount of the enzyme itself. In such cases, this may be due to the fact that Hg maintains the optimal conformation of the enzyme for catalysis. It should also be kept in mind that hormonal regulation. throughout the body occurs in interaction with other control mechanisms that regulate the rate of enzymatic reactions. Cyclic 3',5'-AMP as an intermediate for the action of many hormones is of great importance in the realization of hormonal regulation. This compound is formed from ATP in the body by the enzyme adenylate cyclase, and the breakdown of 3',5'-AMP is catalyzed by phosphodiesterase; 3',5'-AMP-mediated effects on steroidogenesis under the action of ACTH and luteinizing hormone. Effects on lipolysis and glycogenolysis by catecholamines, glucagon and insulin, release of pituitary convexital hormones by hypothalamic releasing factors, etc. The intracellular effects of 3',5'-AMP lie in its effect on enzyme activity Cyclo-AMP is bound to an inactive protein kinase unit (receptor), the catalytic subunit is released and an activated protein kinase is formed. It has been shown that cyclo-AMP not only mediates the action of hormones, particularly aldosterone and calcitonin. A very important aspect of hormonal regulation. is the effect of hormones on the permeability of cell membranes. Components of the internal environment such as ions, water, carbohydrates, amino acids and fats pass through the membranes, which largely determine the physical and chemical state of the cell's internal environment. The cell membrane (see biomembrane) is about 8 nm thick and consists of a lipid bilayer coated on both sides by a protein membrane. The cell membrane is not homogeneous throughout the cell and is composed of different functional units. Insulin changes the membrane from laminar to micelle (sphere), with a concomitant rearrangement of lipid polar groups and the appearance of "channels" that change permeability. The influence of hormones on the functional state of cell membranes is a very important part of hormonal regulation for three main reasons: 1) because permeability can be controlled in this way; 2) because hormones act on the activity of adenylate cyclase, which is incorporated into the membrane in many tissues; and 3) because metabolic membranes are targets for hormones in the blood because they are the first point of contact with the organ. Classification of Hormones According to their chemical nature, hormones are divided into the following groups:

1) peptide hormones - hormones of the hypothalamus, pituitary gland, insulin, glucagon, parathyroid hormones;
2) amino acid derivatives - adrenaline, thyroxine;
3) steroids - glucocorticoids, mineralocorticoids, male and female sex hormones;
4) eicosanoids - hormone-like substances that have a local effect; they are derivatives of arachidonic acid (polyunsaturated fatty acid).

According to the place of formation, hormones are divided into hypothalamic, pituitary, thyroid, parathyroid, adrenal glands (cortical and brain matter), female sex hormones, male sex hormones, local or tissue hormones.

According to their action on biochemical processes and functions, hormones are divided into:

1) hormones that regulate metabolism (insulin, glucagon, adrenaline, cortisol);

2) hormones regulating calcium and phosphorus metabolism (parathyroid hormone, calcitonin, calcitriol);
3) hormones regulating water-salt metabolism (aldosterone, vasopressin); 4) hormones regulating reproductive function (female and male sex hormones);
4) hormones regulating endocrine gland functions (adrenocorticotropic hormone, thyrotropic hormone, luteinizing hormone, follicle-stimulating hormone, somatotropic hormone);
5) stress hormones (adrenaline, glucocorticoids, etc.);
6) Hormones that influence our bodies (memory, attention, thinking, behaviour, mood: glucocorticoids, parathyroid hormone, thyroxine, adrenocorticotropic hormone).

Properties of the hormones

1) High biological activity. The concentration of hormones in the blood is very small, but their action is strong, so even a small increase or decrease in hormone levels in the blood causes various, often significant, deviations in metabolism and organ function and can lead to pathology.
2) Short life time, usually from a few minutes to half an hour, after which the hormone is inactivated or destroyed. But with the destruction of the hormone its action does not stop, but can continue for hours or even days.
3) Distance of action. Hormones are produced in some organs (endocrine glands) and act in other organs (target tissues).
4) High specificity of action.

The hormone exerts its action only after binding to the receptor. The receptor is a complex protein-glycoprotein consisting of protein and carbohydrate parts. The hormone binds to the carbohydrate part of the receptor. The structure of the carbohydrate part has a unique chemical structure and corresponds to the spatial structure of the hormone. Therefore, the hormone unmistakably, precisely, specifically binds only to its receptor, despite the low concentration of the hormone in blood. Not all tissues respond equally to the hormone. High sensitivity to the hormone belongs to the tissues, which have receptors to the hormone. In such tissues the hormone causes the most pronounced shifts in metabolism and function. If receptors to the hormone are present in many or almost all tissues, such hormone has a general effect (thyroxine, glucocorticoids, somatotropic hormone, insulin). If receptors to the hormone are present in a very limited number of tissues, such hormone has a selective effect. Tissues that have receptors to a given hormone are called target tissues. In target tissues, hormones can affect the genetic apparatus, membranes, and enzymes. Types of biological action of hormones.

1) Metabolic - the effect of the hormone on the body is manifested by the regulation of metabolism (e.g., insulin, glucocorticoids, glucagon).
2) Morphogenetic - the hormone acts on cell growth, division and differentiation during ontogenesis (for example, somatotropic hormone, sex hormones, thyroxine).
3) Kinetic or triggering - hormones can trigger functions (e.g., prolactin - lactation, sex hormones - sex gland function).
4) Corrective. Hormones play the most important role in human adaptation to various environmental factors.

Hormones change metabolism, behavior and functions of organs so that the body can adapt to altered conditions of existence, i.e. they perform metabolic, behavioral and functional adaptation, thereby maintaining the constancy of the internal environment of the body. Mechanism of action of peptide hormones and adrenaline Receptors for these hormones are located on the outer surface of the cell membrane, and the hormone does not penetrate into the cell. The hormone action in the cell is transmitted by so-called second mediators, which include cyclic AMP (cAMP), cyclic GMP (cGMP), calcium, inositol triphosphate, diacylglycerol (diglyceride), and some others. In the regulatory signal transduction system, they are called 7' second mediators because the first mediator is the hormone itself. Each of the second intermediaries activates a specific protein kinase. Protein kinases phosphorylate enzymes, and this changes the activity of the enzymes. The main second mediator is the cytoplasmic monophosphate. Most hormones act through it. Other intermediaries, acting through their proteinkinases, can change the amount of tsAMP in the cell by increasing or decreasing the activity of enzymes that synthesize or degrade tsAMP. tsAMP Cyclic AMP is formed in the cell from ATP by the adenylate cyclase system. The adenylate cyclase system includes the receptor, the G-protein, and the enzyme adenylate cyclase. The G-protein is so called because it can bind guanyl nucleotides (GTP or GDF). There are two types of G-protein: Gs stimulates adenylate cyclase and increases cAMP production and Gi inhibits adenylate cyclase and decreases cAMP production. Gs and Gi proteins exert their activating or inhibitory effects only when in the active state. G-protein ATP AMP +H2O Phosphodiesterase Adenylate cyclase FFn Cyclic-3', 5'-AMP . The metabolism of cAMP 8 is active when bound to GTP, and conversely, bound to GDP, the G-protein is inactive. As long as the hormone does not act on the cell, the adenylate cyclase system is inactive; all of its components are dissociated and GDP is bound to the G-protein. However, after the hormone binds to the receptor, the conformation of all components of adenylate cyclase system is sequentially changed, G-protein exchanges GDF for GTP, becomes active, and activates adenylate cyclase, which synthesizes cAMP from ATP. Cyclic AMP, in turn, activates a specific cAMP-dependent protein kinase (protein kinase A), which phosphorylates intracellular enzymes, resulting in changes in enzyme activity. The adenylate cyclase system Protein kinase consists of 4 subunits (tetramer), two of which are regulatory and two of which are catalytic. In this form, the protein kinase is inactive. When the protein kinase binds 4 molecules of tAMP, the catalytic subunits detach (dissociate) and phosphorylate proteins (enzymes), altering their activity. 9 The cAMP is degraded by phosphodiesterase. Activation of protein kinase A by cAMP K are catalytic subunits, P are regulatory subunits of cGMP Cyclic GMF is formed from GTP by guanylate cyclase in a manner similar to cAMP synthesis. Cyclic GMF activates a specific cGMP-dependent protein kinase or protein kinase G, which phosphorylates the enzymes, which is accompanied by a change in their activity. Like cAMP, cGMP is degraded by phosphodiesterase.

Conclusions: The action of the hormone on the membrane can be seen as part of the first interaction between the hormone and the tissue, i.e., specific hormone receptivity. Although the question of the penetration of protein hormones into the cell has not yet been unequivocally resolved, it is thought that it is at the membrane that the "trigger" response occurs, unleashing a series of actions of these hormones. For steroid hormones, it has been established that they penetrate cells and bind mainly to specialized receptor proteins. This issue is most extensively studied for estrogens. In the case of feminizing tumors found in estrogen-sensitive tissues, it is similar to the mercury abnormalities characteristic of male genitalia that can be observed with excessive estrogen exposure. However, even in diseases unrelated to the endocrine system, changes in H. r. are usually observed, although not always pronounced, because the endocrine system is abnormally sensitive to all influences. The boundary between permanent and pathological shifts in hormonal regulation is often very difficult to draw. There are specific properties of H. r. changes in tumors (for example, in the tissue of experimental hepatomas in animals the ability of some enzymes to change activity in response to corticosteroid administration is lost, whereas in the liver tissue bordering the tumor this ability is preserved). In addition, when prescribing hormonal therapy, one should keep in mind the possibility of serious metabolic disorders, especially when taking hormones for a long time.

Literature:

1. Biochemistry of hormones and hormonal regulation, ed. by N. A. Yudaev, M., 1976;
2. Gorizontov'P. D. and Protasova T. N.
3. The role of ACTH and corticosteroids in pathology, M., 1968, bibliogr;
4. Protasova T.N. Hormonal regulation of enzyme activity, M. 1975, bibliogr;
5. Contemporary issues of endocrinology, ed. by N. A. Yudaev, v. 3-4, M., 1969- 1972;
6. Utevsky A. M. and Rasin M. C.
7. Catecholamines and corticosteroids (molecular aspects of interrelations between two major adaptation systems), Usp. sov. biol., vol. 73, no. 3, p. 323, 1972, bibliography;
8. Frolkis V. V. Regulation, adaptation and aging, L., 1970, bibliography; Yudaev N. A.
9. On the action of hormones at the level of transmission of genetic information, Probl, Endocrin and Hormonoter, vol. 13, No. 1, p. 112, 1967, bibliography;
10. Yudaev N. A. and Protasova T. N. Molecular mechanisms of hormonal control in animals, Jour. All-Union Chemical Society, vol. 18, JSIa 2, p. 160, 1973, bibliogr;
11. Yudaev N. A. et al. Cyclic nucleotides as intracellular transmitters of hormone action, Usp. sov. biol." vol. 80, no. 3, p. 351, 1975, bibliogr;
12. Baulieu E. E. Etudes sur le mode d'action des hormonesst^roides sexuelles, P.-N.Y., 1974; Biochemical actions of hormones, ed. by G. Litwack, v. 1-2, N. Y. - L., 1970-1972;
13. Prieden E. H. Chemical endocrinology, N. Y., 1976; Malkinson A. M. Hormone action, L., 1975; Schulster D., Burstein S. a. Cooke B. A. Molecular endocrinology of the steroid hormones, L., 1976.