

# GENERAL WAYS OF MANAGEMENT AND HIERARCHY OF REGULATORY SYSTEMS

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**Annotation:** The article provides information on the general ways of regulating the body and the hierarchy of regulatory systems, as well as the general characteristics and properties of hormones.

**Keywords:** Control systems, endocrine system, immune system, ontogeny, enzyme, hormone, peptide.

• As a result of the action of control mechanisms, the speed of all chemical reactions and physicochemical processes in the cells is harmonized, the functions of all organs are harmonized and the body responds to changes in the external environment. In the normal functioning of multicellular organisms, there must be a connection between all cells, organs, and tissues. This connection is made through 4 management systems:

• Control is carried out by nerve impulses and neurotransmitters through the central and peripheral nervous system;

• Endocrine system - hormones released from the endocrine glands into the bloodstream regulate metabolic processes in target cells;

• Paracrine and autocrine system - their products are released into the intercellular space and bind to nearby cells (prostaglandins, JCT hormones, histamine, etc.);

• Immune system - through specific proteins (cytokines, antibodies).

• Hormones are integrative regulators. The physiological effects of hormones depend on various factors, for example: the concentration of hormones (rate of secretion, metabolism, inactivation and excretion), the propensity to protein carriers, the number of receptors in target cells. Hormone levels are controlled

through feedback. Most hormones act through the hypothalamic-pituitary system, some are subordinated to the MNS. Cytokines, mainly small-molecule proteins, play an important role in intercellular communication. They bind to receptors on the cell membrane, transmit the signals to the nucleus, and provide cell differentiation through the induction of certain genes. Cytokines are characterized by:

- Synthesized as a result of the immune response, are mediators of immune and inflammatory reactions, mainly autocrine, sometimes with paracrine and hormonal effects;
- Affects growth and differentiation factors;
- Has pleiotropic activity (polyfunctional).

General ways of control and hierarchy of regulatory systems. Due to the influence of the control system, the organism works in an optimal mode and is able to respond to external impressions as well as internal changes. The fact that the internal environment of the body remains the same is called homeostasis. Some indicators may change in the following cases of the organism:

1. Ontogeny. During ontogeny, the activity of different genes varies, some of which cease to function, and some become active at certain periods. As a result, metabolic processes, organ structure, functional status change.

2. Cyclic changes (biorhythms). It is known that the activity of enzymes, the amount of hormones and some metabolites fluctuate cyclically. These changes may depend on the season of the year, the time of day.

3. Changes in physiological activity. They depend on the functional state of the motor activity, nervous system, sensory organs, digestive system.

4. Adaptive changes in the body due to external factors. An example of this is the increase in heat production in the cold, the increase in hemoglobin concentration when the amount of oxygen in the air is low.

5. The reaction of the external environment to response to damaging factors. Examples include the synthesis of antibodies against antigens, an increase in the synthesis of microsomal hydroxylases under the influence of foreign substances, the formation of thrombi when blood vessels are damaged, an inflammatory reaction, and so on.

The regulation of metabolism plays a special role in maintaining homeostasis in the body, and its following levels are distinguished:

First level. Includes intracellular mechanisms of administration. In this case, the activity of enzymes plays a special role and can be affected in three ways:

A) can be affected by inhibition or activation of enzymes, changes in environment and temperature, cofactors and coenzymes, the amount of intermediate metabolites.

B) by induction or repression of the synthesis of enzymes and some proteins, they can change their amount by changing the rate of decomposition.

C) by influencing the passage of substances through the membrane.

The endocrine system is the second level of management. In response to a specific effect, hormones are released from the endocrine glands, and they, according to internal mechanisms in the target cells, alter the metabolism there accordingly. The hormone, which performs its function, is broken down by special enzymes.

The third level of control is the receptors with the nervous system that receive information from both the external and internal environment. Mediator

leads to changes in metabolism through intracellular mechanisms of regulation. Endocrine cells that respond by synthesizing and releasing a hormone in response to a nerve impulse can also be effector cells.

The three levels of control cited are interconnected and operate as a single system. The addition of hormone production to the control system allows for remote control, i.e. the cell is exposed to other cells in addition to controlling its own metabolism.

Hormones are substances of an organic nature that, after being formed in special cells of the endocrine glands, pass into the bloodstream and have a regulatory (regulatory) effect on metabolism and physiological functions.

According to their chemical nature, hormones are divided into three groups:

1. Hormones of peptide (protein) nature.

a) complex proteins - glycoproteins; these include FSH, luteinizing hormone, TSH, etc;

b) simple proteins: prolactin, TSH, insulin, etc;

c) peptides: include ACTH, glucagon, calcitonin, somatostatin, vasopressin, oxytocin, etc;

2. Amino acid products include: catecholamines, thyroid hormones, melatonin, etc .;

3. Steroid compounds and fatty acid products (prostaglandins).

A) Steroids are a large group of hormonal substances; these include adrenal hormones (corticosteroids), sex hormones (androgens and estrogens), 1,25 - dioxycholecalciferol, and others.

B) Eicosanoids are products of polyunsaturated fatty acids (arachidonate) that contain three classes of compounds: prostaglandins, thromboxanes, and leukotrienes. They are water-insoluble unstable compounds that exert their effects on cells near the site of synthesis.

E. Sutherland's research and the discovery of cyclic adenosylmonophosphate play a major role in the emergence of modern understanding of the molecular basis of the biological mechanism of action of many hormones. It is known that the direction and fine-tuning of the information transfer process, first of all, provides the cell with the presence of receptor molecules that carry hormonal information. These information receptors cause a change in the concentration of binders within the cell, called a secondary messenger. The amount of messenger depends on the activity of the enzymes that produce and break them down.

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