Adaptation to Physical Load and Reserve Capacity of the Organism- Stages of adaptation

Vladimir Borisovich
Moscow

Contents.

Introduction

The variety and variability in combination with the dynamic stability - the basic properties of nature, part of which is Man. Regardless of views on the starting time of the origin of life on Earth all living things (plants and from the simplest to the most highly developed creatures) since its inception has been vested in another, perhaps the most important feature - adaptability, which in one way or another ensure survival sometimes in the form previously incompatible with the life conditions of their existence in the environment. Adaptable, as a property of living, is still one of the main prerequisites for the evolution of it. However, evolution as a global process of species change inevitably involves special cases of the individual adaptive changes within the species of living beings during their relatively short life cycle, although these personality changes are not a guarantee of the evolution of a species. That study and knowledge of the laws of change, adaptation and existence in an environment of living beings throughout their individual life cycle is most important for science and practice, one way or another connected with the investigation and enforcement of their lives.

Specialists, the object of which is Man, you must first understand that the human body is relatively open and self-organizing samostrukturiruyuscheysya dissipative system subjected to various and numerous influences Environments. And it is a systematic approach should be the basis of representations of the mechanisms and nature of the process of adaptation - adaptation of the organism to the conditions of his existence in the environment.

1. "Stress" and nonspecific reactions of the organism to sredovye impact

Studies of reactions and states of the organism in response to extreme influences were started by Charles Darwin (1872). They conducted the study of emotional affects humans and animals, and have drawn attention to similarities and differences are studied emotional expressions [Ch Darwin, 1953]. Studies W. B. Cannon (1927) have shown the importance sympathoadrenal-adrenal system in the mechanisms of emergency mobilization of the organism during emotiogenic reactions. In the works of Pavlov (1900, etc.) and his disciples AD Speransky (1935, 1936, 1955), MK Petro ¬ howl (1946, 1955), Bykov (1947, 1960) it was shown that exposure to extreme stimuli arise generalized violations trophics, diseases of internal organs. AD Speransky (1935) in his monograph, "Elements of the build ¬ Niya theory of medicine", based on the findings of experimental data on similar changes in the nervous system and the presence of generalized process as disorders trophism, krovoizliya ¬ ny, ulcers in the stomach and intestines, changes in the adrenal glands and other organs, making a conclusion on the standard forms of imple ¬ girovaniya organism to extremely annoyed ¬ ny. And in the works of AD Speransky say about the leading role of the nervous system in these same type of generalized responses, and that it is the nervous system determines the integrity of the reactions of those mnogozvenevye mechanisms that are involved in the implementation of adaptive-compensatory processes of the organism [Review B . Fedorov, 1990].

However, the beginning of "the era of the general adaptation syndrome 'is placed in an ambitious attempt to Canadian scientist H. Selye open a new hormone. Exposing the corpses of slain them in laboratory animals, which previously provided extracts of the ovaries and placenta, or a solution of formalin, H. Selye (1936) found a set of similar changes in various organs and tissues of the test material. This was reported in 1936 in the journal "Nature" [N. Selye, "Syndrome produced by Diverse Nocuous Agents", 1936]. In connection with this Selye H. (1960) about "the key to understanding and evaluation ...": the discovery of the general (later - "nonspecific") structural changes in the carcasses of laboratory facilities, exposed in vivo effect of different factors - both times is undeniable and, above all physiological fact requiring its own explanation.

Replying to a question posed to them by the degree of nonspecific discovered them syndrome, Selye H. (1960) says: "... we have not seen adverse incentives, which could not cause our syndrome. Significantly, the original place of the term "stress" incharacteristics of the syndrome of the author used the term "damaging" or "harmful" [H. Selye, 1936].

In the first published in our country monograph Selye (1960), "sounds" a text that seems to be once and for all was to determine the strict framework of the physiological study and use of open-syndrome: "We have called this syndrome" common "because it is called only by those agents that lead to the general state of stress ... and, in turn, causes a generalized, ie, systemic protective phenomenon. " The framework is all the more to be "untouchable", given the recognition of H. Selye, made by him in 1952: "Today ... I am ashamed to say that, despite all the ... possible, I could not add anything significant to the results ¬ there the first primitive experiments and observations, performed in 1936 [G. Selye, 1960].
Should set aside the fact, noted in these earlier studies by H. Selye (1936 and others), but was left without proper attention and himself, and his numerous followers. Here it means scientists have already marked in the first experiments, the various expressions found nonspecific changes in the studied postmortem material (tissues and organs of laboratory animals), the occurrence

of which (according to H. Selye, 1960) was based on lifetime exposure to various active factors. Moreover, it is perfectly acceptable and conformed obtained in experiments in 1936 according to the term "damaging impact" does not satisfy H. Selye primarily in connection with the results of new experiments. It turned out that even such well physiological stimu ¬ ly, as a short-term muscle tension, mental excitement or short-term cooling, already causing ¬ UT certain manifestations of anxiety responses, such as STI ¬ mulyatsiyu adrenal cortex "[G. Selye, 1960]. Easy to see that here we are no longer talking about a syndrome that includes a triad detected H. Selye in 1936, the changes obtained in response to the damaging effects of extreme - while the objective regi ¬ Q Quiet stress depended on the occurrence of gross structural defects, which were caused by only the most severe stressors "[H. Selye, 1952].

Ultimately G. Selye simply combine all the stimuli of the single term "stressor", and any body's response to external and internal exposure suggested considering "stress." Moreover, in the later works of H. Selye's "stress" has ceased to be a generalized response of the organism, as was characteristic of any non-specific manifestations at any level of organization of living matter [C. E. Pavlov, 2000]. And, oddly, is making a real physiological term into something totally non-specific ("The word" stress "is defined as one of the most inexact science glossary of terms and compared with the word sin: both these words represent different things to different people, they are both short and emotionally rich, expressing something that otherwise would be described by the lengthy expression "- U. Söderberg, 1970," all desire to nonspecific changes arising from ... the body, interpreted as a manifestation of the stress response makes this vague notion of and extremely uncertain "- PD Horizons, TN Protasov, 1968) has been unconditionally accepted scientific majority.

However, it is the results obtained by H. Selye in his early and subsequent research and opposition to put forward his concept of "general adaptation syndrome" has stimulated a number of national scientists to study the characteristics of a living organism's response to stimuli of different strengths. In particular, it was noted that "not all stimuli evoke the same kind of standard hormonal reactions" [P. DA Horizons, TN Protasov, 1968]. As a result of years of research group of Soviet scientists yielded results indicating that the body reacts differently to stimuli of different strengths [L. X. Harkavy, 1968a, b; MA Ukolova, N. Bordyushkov, L. X. Harkavy, 1968; L. X. Harkavy, 1969; MA Ukolova, L. X. Harkavy, EB Kvakina, 1970; EB Kvakina, MA Ukolova, 1969; EB Kvakina, 1972; L. X. Harkavy, EB Kvakina, 1975; EB Kvakina, L. X. Harkavy, 1975; L. X. Harkavy, EB Kvakina, MA Ukolova, 1977]. They were identified: non-specific reaction to the action of weak stimuli (reaction exercises "), nonspecific reaction to the stimulus of medium strength (activation reaction) and nonspecific reaction to the strong influence (" stress reaction ") [L. X. Harkavy, EB Kvakina, MA Ukolova, 1977, 1979]. It is assumed that the "excessive" in its effect should lead to changes in the human or animal, inconsistent with his life and serve the cause of his death, and consequently the organism's reaction to these actions can not be considered in the course of normal physiology [C. E. Pavlov, 2000, 2001].

2.Osnovnye of the theory of adaptation, Selye Meyerson

Nevertheless, the results of the above studies [L. X. Harkavy, EB Kvakina, MA Ukolova, 1977, 1979 and others] have been ignored by an eminent majority implicitly embarked on the position of H. Selye, not only in taking his notion of the "general adaptation syndrome", but also with respect to "legitimize" his ideas about the proper process of adaptation. In the 70-80-ies of the last century, today it is "born" has appeared a number of works, a development of the H. Selye

in the process of adaptation in general. Of these works are best known works FZ Meerson (1981), FZ Meerson, MG Pshennikova (1988) and VN Platonov (1988).

FZ Meerson (1981) and FZ Meerson, MG Pshennikova (1988) defines "individual adaptation", as "developing in the course of the life process by which the body becomes resistant to certain environmental factors, and thus an opportunity to live in conditions previously incompatible with life and solve problems, particularly insoluble. These authors divide the process of adaptation to an "urgent" and "long term" adaptation.

Urgent adaptation of FZ Meerson (1981) - it is indeed an extraordinary functional adaptation of the body to accomplish this organism work.

Long-term adaptation by FZ Meerson (1981) and VN Platonov (1988, 1997) - Structural adjustment in the body that occur as a result of accumulation in the body the effects of multiple repeated urgent adaptation (so-called "cumulative effect" of sport pedagogy - H . Volkov, 1986) The basis of long-term adaptation FZ Meerson (1981) is to activate the synthesis of nucleic acids and proteins. In the process of long-term adaptation by FZ Meerson (1981) increases mass and increased capacity of intracellular transport systems of oxygen, nutrients and bioactive substances, completed the formation of dominant functional systems, there are specific morphological changes in all organs, responsible for adaptation.

In general idea of the adaptation process FZ Meerson (1981) and its followers fit into the concept that as a result of frequent repetition of "stress" effects on the body as many times it triggers its "urgent" adaptation, leaving footprints, which have already initiated launch long-term processes of adaptation. In the future, there is an alternation of cycles "Adaptation" - "deadaptatsiya" - "readjustment". In this "adaptation" is characterized by an increase in capacity (functional and structural), physiological systems with the inevitable job hypertrophy of organs and tissues. In turn, deadaptatsiya "- the loss of organs and tissues of properties acquired by them in the long-term adaptation, a" readjustment "- re-adaptation of an organism to a certain operating factors (in sports - the" physical exercise ").
VN Platonov (1997) identifies three stages of fixed-term adaptive reactions:
• The first stage is related to the revitalization of the various components of a functional system that ensures the implementation of this work. This is reflected in a sharp increase in heart rate, level of pulmonary ventilation, oxygen consumption, lactate accumulation in the blood, etc.
• The second stage occurs when the activity of the functional system proceeds with stable characteristics of the basic parameters of its security, in the so-called steady state.
• The third stage is characterized by failure to strike a balance between the request and its satisfaction because of fatigue of the nerve centers that provide the regulation of movements and the exhaustion of carbohydrate resources of the organism.
Formation of "long-term adjustment reactions" (author's saved version) according to VN Platonov (1997) also occurs phasically:
• The first stage is related to the systematic mobilization of functional resources an athlete in the implementation of training programs a certain direction in order to stimulate long-term adaptation mechanisms based on the summation of the effects of multiple repeated urgent adaptation.
• In the second stage against the backdrop of steadily increasing and systematically repeated loads is an intensive course of structural and functional changes in organs and tissues of the corresponding functional system. At the end of this stage, there is hypertrophy of the necessary

bodies, coherence of the various parts and mechanisms to ensure effective engagement of the functional system in the new conditions.
• The third stage features a steady long-term adaptation, as expressed in the presence of the necessary reserve to ensure a new level of system performance, stability, functional structures, the close relationship of regulatory and executive mechanisms.
• The fourth stage occurs when irrationally constructed, usually too intense workout, malnutrition and rehabilitation and is characterized by wear of individual components of a functional system.

2.1.Adaptatsionnye changes in the cardiovascular system

Heart, adapted to physical activity, is highly contractile ability. But it retains a high capacity for relaxation in diastole at a high rate reductions, resulting from improved processes, regulation of metabolism in the myocardium and the corresponding increase in its mass (hypertrophy of the heart).
Hypertrophy - normal morphological phenomenon of enhanced contractile activity (hyperfunction) of the heart. If the density of capillary bed per unit mass of the heart when it increases or remains at a level characteristic of normal myocardium, hypertrophy occurs in normal physiological limits. Cardiac muscle has no lack of oxygen at the hard work. Moreover, the functional load per unit of cardiac mass decreases. Consequently, heavy physical load will be transported by a heart with a smaller functional strain.

Depletion of energy sources for intense load stimulates the synthesis of protein structures of cellular elements: a contractile and energy (mitochondria). If the depletion of energy sources than the physiological norm, there may be strained, the failure of adaptation. In the normal development of the heart at 1 mm3 of muscle mass alone revealed 2300 capillaries. When muscular work revealed an additional about 2000 capillaries. Long-term adaptation provides increasing biosynthetic processes in the heart muscle and increase its mass. For periodic physical stress adaptation of the heart is stretched in time, rest periods of stress lead to a balanced increase in the structural elements of the heart. Mass of the heart is increased within 20-40%. The capillary network grows in proportion to the increasing mass. Trained, moderately hypertrophied heart in conditions of relative physiological rest has a lower metabolism, moderate bradycardia, reduced cardiac output. It works on 15-20% more economical than untrained. When systematic muscular work in the cardiac muscle of the trained heart rate decreased glycolytic processes: energy products consumed more sparingly.
Morphological adjustment of the heart are manifested as an increase in muscle mass, and cellular energy machinery - the mitochondria. Also increases the mass of membrane systems. In other words, sensitivity of the heart to sympathetic effects that amplify its function during muscular work increases. Simultaneously improving mechanisms economization: at rest and during low-intensity stress the heart works with low power consumption and the most efficient ratio of the phase reduction.
If contractile cardiac mass increases by 20-40%, then the functional load per unit mass is correspondingly reduced. This is one of the most reliable and effective mechanisms for preserving the resource potential of the heart.

As demonstrated by practical experience, the young athletes who have physiologically hypertrophied heart, are well adapted to physical exercise of moderate power. When the load limit of power they have clearly seen giperdinamicheskim syndrome. Restorative processes are

fast. Useful capacity of the heart increases as compared with untrained approximately two times. Meanwhile, the load per unit mass of the trained heart at maximum work increased to 25%. In other words, an overload of the heart is practically eliminated even under very intense muscular work, characteristic of modern sport.
Increase in heart rate and contractile ability of the heart - the natural adaptive response to stress. Not accidentally heart rate retains its significance as an indicator of adaptation of the heart when you use any, the most modern functional tests with physical load. Muscular work requires a high flow of oxygen and substrates to the muscles. This is to ensure increased blood flow through the working muscles. Therefore an increase in minute volume of blood flow at work - one of the most reliable mechanisms for urgent adaptation to dynamic loads. In the heart of untrained adult reserves increase the stroke volume of blood exhausted already with heart rate 120-130 beats / min. Further growth of minute volume is only due to heart rate. As the trenirovannosti expands the range of HR, within which the stroke volume of blood continues to increase. We vysokotrenirovannyh athletes and children, it continues to grow and with heart rate 150-160 beats / min.

In the very heart muscle urgent adaptatstonnye changes are manifested in the mobilization of energy resources. Primary substrate oxidation in heart muscle are fatty acids, glucose, to a lesser extent - amino acids. The energy of oxidation is accumulated by mitochondria in the form of ATP, and then transported to the contractile elements of the heart.
When the blood stroke volume reduction of the heart are becoming more frequent. This occurs due to more efficient use of energy of ATP. Increase of the heart combined with the improvement of the recovery processes during diastole [Ya M. Kotz, 1983].

2.2.Adaptatsionnye changes in respiratory system and blood

2.2.1.Adaptatsionnye change the system of external respiration.

Muscular work is repeated (15-20 times) increase in pulmonary ventilation. Athletes who must train mostly on endurance, minute volume of pulmonary ventilation reaches 130-150 l / min or more. In untrained men increase in pulmonary ventilation at work is the result of rapid breathing. Athletes with a high frequency of breathing increases and the depth of respiration. This is the most rational way of urgent adaptation of the respiratory apparatus to the load. Reaching the limit values of pulmonary ventilation, which is characteristic of highly skilled athletes, is the result of a high consistency of acts with the reduction of the respiratory muscles, as well as movements in space and time: disorder of the coordination work of the respiratory muscles breaks the rhythm of breathing and leads to deterioration of pulmonary ventilation.

Decisive role in the growth of the volume of pulmonary ventilation in the early work belongs to neurogenic mechanisms. Impulses from the shrinking of the skeletal muscles and descending nerve impulses from the motor areas of the cerebral cortex of the brain stimulate the respiratory center. Humoral factors of regulation are included later in the ongoing work and the achievement of adequate quantities to her pulmonary ventilation. Regulatory role of CO_2 is manifested in the maintenance of the required rate of respiration and establishing the necessary matching of pulmonary ventilation value of physical activity.

Systematic muscular activity accompanied by an increase in strength of respiratory muscles.

Clearly growing power of the respiratory movements. The velocity of the air stream in athletes reach 7-7,5 l / s on inspiration and 5.6 l / s on exhalation. In untrained people inhale the power does not exceed 5-5,5 l / s, exhaling - 5 l / sec.

An important physiological mechanism for increasing the efficiency of external respiration is to fix conditioned reflex connections, ensuring coordination of breathing with the duration of the implementation of individual parts of a holistic instrument (for example, when swimming). This is clearly manifested systemic control physiological functions [J. M. Kotz, 1983].

2.2.2.Adaptatsionnye changes in the blood system.

The primary response of the blood system to physical stress are changes in the formed elements of blood. The most distinct changes in the so-called white blood cells - white blood cells. Myogenic leukocytosis characterized by a predominant increase in the granular leukocytes in the general bloodstream. Simultaneously, there is a destruction of leukocytes: in strenuous exercise sharply reduced the number of eosinophils. The structural material formed in their decay, is on the plastic needs to be reinstated and the biosynthesis of cellular structures.

Exercise-related emotional stress, causes more significant shifts in the composition of blood. Increase in the number of red blood cells - a reliable tool for improving resistance to muscle hypoxia. Normal wbc after physical activity is restored, usually within a day. The system of so-called red blood cells recovered more slowly: after 24 hours of rest are saved and the increased number of red blood cells, and their immature forms - reticulocytes. Athletes 16-18 years after strenuous muscular work also appear immature forms of platelets. As a result of muscular activity of the blood coagulation system is activated. This is one of the manifestations of immediate adaptation to the effects of physical activity. In the process of vigorous motor activity possible injury with subsequent bleeding. Preprogramming "ahead of" such a situation, the body increases the protective function of blood clotting. This is an unusual adaptation of a rainy day, in case of damage during muscular work. Restoration of blood clotting occurs within 24-36 hours after the load [Ya M. Kotz, 1983].

2.3.Rol hypothalamic-pituitary-adrenal system in the process of adaptation

Structural changes at the cellular and organ levels in physical activities begin with the mobilization of endocrine function, and in the first place - the hormonal system of the hypothalamus-pituitary-adrenal axis. Schematically it looks as follows. Hypothalamus converts neural signals real or impending physical activity in the efferent, manager, hormonal signal. In the hypothalamus hormones are released that trigger the hormonal function of the pituitary. Leading role in the development of adaptive reactions among these hormones plays kortikoliberin. Under his influence is released adrenocorticotropic hormone (ACTH), which causes the mobilization of the adrenal glands. Adrenal hormones increase the body's resistance to physical stresses.

Under normal conditions of life of the organism in the blood levels of ACTH and serves as a regulator of its secretion by the pituitary. With increasing the content of ACTH in the blood of its secretion is automatically inhibited. But with strenuous exercise system of automatic regulation changes. The interests of the organism in the period of adaptation require intensive adrenal function, which is stimulated by increasing concentrations of ACTH in the blood.

Adaptation to physical exertion and is accompanied by structural changes in the tissues of the adrenal glands. These changes lead to increased synthesis of corticoids hormones. Glucocorticoid hormone activates several enzymes that catalyze the formation of pyruvic acid and its use as an energy material in the oxidative cycle. At the same time stimulated and processes of resynthesis of glycogen in the liver. Glucocorticoids increase and energetic processes in the cell, release of biologically active substances that stimulate the body's resistance to external influences.

Hormonal function of adrenal cortex during the muscular work of a small volume remains virtually unchanged. During a large volume load is the mobilization of this function. Inadequate, excessive stress causes inhibition of the function. This kind of defensive reaction of the organism, warning depletion of the functional reserves. Secretion of hormones of the adrenal cortex changes with systematic muscular work in general, the rule economization. Increased production of hormones adrenal medulla contributes to energy production, increased mobilization of liver glycogen and skeletal muscle. Adrenaline and its predecessors provide the formation of adaptive changes to the beginning of physical exertion. Thus, the adrenal hormones contribute to the formation of the complex adaptive responses aimed at improving the stability of cells and tissues of the organism to the action of physical activity. I must say that this beautiful adaptive effect is restricted to endogenous hormones, ie, hormones, glands develop its own body, and not imposed from outside. The use of exogenous hormones has no physiological sense. In function of the cerebral and cortical layers of the adrenal glands in the process of adaptation to physical loads there are new relations of mutual correction. Thus, with increased production of adrenaline - the hormone adrenal medulla - is increasing and production of corticosteroids, limiting its catalytic role. In other words, the conditions for an optimal and adequate load change hormone production and cerebral cortical layers of the adrenal glands.

3.Main of the modern theory of adaptation

3.1. Some criticisms of the theory of adaptation, Selye Meyerson

Nevertheless, the theory of adaptation "in the wording FZ Meerson (1981), FZ Meerson, MG Pshennikova (1988) and VN Platonov (1988, 1997) is not able to respond to a number of extremely important for the theory and practice issues [S. E. Pavlov, T. Kuznetsova, 1998; S. E. Pavlov, 2000, 2001]. The monograph C. E. Pavlova (2000) A whole chapter devoted to a critical analysis of the main provisions of the "mainstream" (in the words of the author) "theory of adaptation", the main claim to which the part of the author are as follows:

1. Nonspecific reaction in the "theory of adaptation" FZ Meerson (1981) and his followers are only "stress", which to date in the wording of the majority of authors completely deprived of its original physiological sense. On the other hand, the return of the term "stress" of its original meaning makes the process of physiological adaptation (and hence - of life) as amended by FZ Meerson and his followers, discrete, and that is contrary to logic and the laws of physiology;

2. "The theory of adaptation" in the wording FZ Meerson (1981), FZ Meerson, MG Pshennikova (1988), VN Platonov (1988, 1997) is predominantly non-specific focus, that, given the emasculation of nonspecific level adaptation does not allow to consider it "working";

3. Perceptions of the adaptation process FZ Meerson (1981) and VN Platonov (1988, 1997) have an unacceptably mechanistic, primitive, linear (adaptation-deadaptatsiya-readjustment), that does not reflect the essence of complex actually occur in vivo physiological processes;

4. In "adaptation theory" advocated FZ Meerson (1981) and his followers ignored the principles of the systems in the evaluation processes of the organism. Moreover, their position in the process of adaptation can in no way be called a system, and, consequently, their proposed "theory of adaptation" is not applicable for use in research and practice;

5. Separation of the whole process of adaptation to an "urgent" and "long term" adaptation physiologically unreasonable;

6. Terminology Database "dominant theory of adaptation" does not correspond to the physiological content of what is happening in the intact organism adaptation process

7. If you stand on the position of "the theory of adaptation" Selye, Meerson, we should recognize that the best athletes in all sports should be bodybuilders - that they have the maximum development of all muscle groups. It 1. least it is not. And by the way today's understanding of the term "fitness" (to a greater degree of pedagogical concepts) does not correspond to the physiological reality just in connection with the rejection of sports and educational realities of the majority of the physiological [S. E. Pavlov, 2000];
3.2.Teoriya functional systems PKAnohin

For the first time the concept of the systems in the Russian physiology to the study of life of the whole organism, and annexed to the processes of higher nervous activity introduced by Pavlov: "... Man is, of course ... the system, like any other in nature, subordinate to the inevitable and same for all the laws of nature, but the system in the horizon of our scientific vision, only on the highest self-regulation ... system in the highest degree of self-regulating, supporting itself, restoring ... "[I. Pavlov, 1951]. However, with the expansion of knowledge about the mechanisms of behavioral act, development and improvement of research methodology, with the advent of new facts that conflict with the canons of the reflex theory, bounded the narrow limits of afferent-effector relationships, it became increasingly clear that the conditioned reflex, explains the a behavioral act on the Cartesian formula "stimulus-response can not fully explain the adaptive behavior of humans and animals. According to the classical reflex principle, the behavior ends only action, although important is not so much the action as their adaptive results [P. Anokhin, 1949; KV Sudakov, 1987].

Intensive growth in the number of results of different studies may lead researchers to a sense of helplessness in the flood analysis of the facts. Clearly, only to find some general principle may help to understand the logical relationships between the individual facts and allow for a different, more high-level design of new studies. Systems approach to science makes it possible to comprehend what can not be understood in an elementary analysis of the accumulated research material. Systemness - the one key that allows you to connect the level of integrity and the level of private, the result obtained analytically, to fill the gap that separates these levels. Creating the concept of functional systems - a serious problem whose solution allows us to formulate the principle of work, located on one side of integrity and bearing the features of the integrative whole, but on the other - in the analytical field. A functional system allows for study in any given sector of the whole by any methods. But these studies are in close unity with the

functional system that shows where and how these studies are conducted [P. Anokhin, 1978]. "... Only a physiological analysis at the level of the functional system can include an entire organism in the integral acts without loss of physiological levels of interpretation of its individual components" [P. Anokhin, 1968].

It has been noted many attempts to create systems theory. Moreover, a group of authors from NASA was even asked to assign a special science of "biological systems" ("Biologikal Systems Science", 1971). The need for the introduction of a holistic approach when explaining the functions of the organism was felt by most investigators, but solved them in different ways. Among researchers deny the existence of anything specific in the integrity of the organization and attempted to explain it, based only on the properties of the elements of holistic entity, which is typical of the mechanistic approach to understanding the whole. Another group of scientists accept the existence of certain inorganic forces, have the quality of "inspiration" and the formation of an organized whole, to a greater or lesser extent, defending vitalistic position [P. Anokhin, 1978].

With a general understanding of the need for a systematic approach in assessing the integrity and disparate functions of a living organism ("The main problems of biology ... associated with the systems and their organization in time and space" - Norbert Wiener, 1964; "... search for the" system "more high and common to many phenomena of the principle of operation can yield much more than just some analytical methods for the study of particular processes - Anokhin, 1978) to date there is no unity in the interpretation of definition of system by various authors [B. Parin, RM Baevskii, 1966; M. Khananashvili, 1978; OS Andrianov, 1983; VA Shidlovskii, 1973, 1978, 1982; FZ Meerson, MG Pshennikova, 1988; VN Platonov, 1988, 1997, and others]. Moreover, attempts to observe the principles of systemic acquired various forms, among which are allocated:

1. Quantitatively-cybernetic "systems" approach, examining biological systems from the standpoint of control theory and widely used mathematical modeling of physiological functions in attempts to identify common patterns.

2. The hierarchical "system" (or "system-structural") approach, examines the process of interaction of individual parts in the body in terms of their complexity: from molecules - to the cells from cell - to the tissues, from tissues to organs, etc.

3. Anatomical and physiological "systems" approach, reflecting the union of bodies on their physiological functions: the cardiovascular system, digestive system, nervous system "and so on. [P. Anokhin, 1978; KV Sudakov, 1987].

There is hardly one direction in modern science, where one way or another was not used to the term "system", which has moreover a very ancient origins. However, the term "system" in most cases is used as a characteristic of something assembled together, orderly, organized, but without mention or even the "implication" the criterion by which the components are assembled, ordered, organized by [P. Anokhin, 1978]. As an example: is a common use of scholars and practitioners in medicine and physiology of the phrases "cardiovascular system", "lungs", etc., which was adopted by them as evidence of "systemic" their way of thinking in the analysis of certain existing facts. Introduction of the system, as interacting components and, in fact, their interaction "can not create the system, since the analysis of the true laws of

functioning in terms of a functional system reveals possible mechanism of" assistance "component than their" interaction "and" ... the system at its formation acquires its own and specific principles of organization, not transferred to the principles and properties of those components and processes of which formed a complete system "[P. Anokhin, 1978]. However, a characteristic feature of the systems approach is that in research can not be an analytical study of a partial object without precise identification of the private in a large system "[P. Anokhin, 1978].

The theory of functional system was developed by PK Anokhin (1935) as a result of its research compensatory adaptations of disturbed functions of the organism. As shown by these studies, any compensation of disturbed functions can take place only in mobilizing a large number of physiological com ¬ nents, often located in different parts of the central nerve ¬ dimensional system and working the periphery, yet always functional ¬ nennyh the union on the basis of receipt of the final adaptive effect . This functional integration of the various localized structures and processes based on receipt of the final (adaptive) effect and has been called "functional system" [P. Anokhin, 1968]. The principle of functional system is used as a unit of autoregulatory devices in the diverse activities of the whole organism. "The concept of a functional system is with ¬ battle primarily a dynamic concept, which ac ¬ cent is put on the laws of the formation of a functional association necessarily finishing ¬ yuschegosya useful adaptive effect and includes devices evaluation of this effect [P. Anokhin, 1958]. The core func ¬ tional system is an adaptive effect, the composition, reinsurance ¬ ku efferent impulses and the inevitable result of the reverse afferentirovanie interim or final in ¬ sposobitelnogo effect. The notion of functional system covers all aspects of the adaptive activity of the whole organism, not only inter ¬ action or any combination of the nerve centers ("a constellation of nerve centers" - Ukhtomskii, 1966) [P. Anokhin, 1958].

According to the theory of functional systems, central a factor which each functional system is the result of its activities, defining the whole organism to normal conditions the flow of metabolic processes [P. Anokhin, 1980]. It is the sufficiency or insufficiency of the result determines the behavior of the system: if the sufficiency of the body goes on the formation of other functional system with another useful result, which represents the next stage in the universal continuum results. In case of insufficiency of the result is stimulation of the activating mechanisms, there is active recruitment of new components, creates a change in the degrees of freedom of action of the synaptic organization and, finally, after several "trial and error" is quite sufficient adaptive outcome. Thus, the system can only be called a set of selective involvement of components, whose interactions and relationships take on the character vzaimosodeystviya components for a particular useful result [P. Anokhin, 1978].
Been formulated the basic features of functional ¬ tional system as an integrative education:

1. A functional system is a central-peripheral formation, becoming, thus, specific device self-regulation. It supports its unity on the basis of the cyclic circulation from the periphery to the center and from the center to the peri ¬ periphery, although it is not "ring" in the fullest sense of the word.

2. The existence of any functional system certainly свя ¬ EZLN obtaining a clearly defined adaptive effect. This is the final effect is determined by a particular distribution ¬ division excitations and activities on the functional system as a whole.

3. Another absolute indication of a functional system is the presence of receptor units, evaluating the results of its actions. These receptor apparatus in some cases may be congenital, in others it may be extensive afferent formation of the central nervous system, perceiving afferents ¬ nuyu signaling from the periphery of the results of actions. Particular feature of the afferent apparatus is that it folds up to get themselves the results of actions.

4. Each result of a functional system forms a reverse flow afferentations, representing all the major recognition ¬ ki (parameters) of the results. In the case where the selection of the most effective results, the reverse afferentation holdfast ¬ lyaet recently most effective action, it becomes a "thunk" ¬ tsioniruyuschey afferentation "[P. Anokhin, 1935].

5. In a behavioral sense, a functional system has a number of additional widely branched devices.

6. It is vitally important functional systems on which the construction of adaptive activity newborn animals to their characteristic environmental factors, have all the above features and architecture are just ripe at the time of birth. From this it follows that combining the functional system (At ¬ CIP consolidation) should become a full-functional at some period of fetal development before birth [P. Anokhin, 1968].

A functional system is always heterogeneous. A specific mechanism of interaction between the components of any functional system is to release them from the excess degrees of freedom are not necessary for this particular result, and conversely, the preservation of all those degrees of freedom that contribute to the result. In turn, the result is a characteristic of its parameters, and thanks to feedback afferentation has the opportunity to reorganize the system, creating a form of interaction between its components, which is most favorable for generating exactly the programmed result. The meaning of the systems approach lies in the fact that the element or component of the operation should not be construed as a separate and independent entity, it must be understood as an element whose remaining degree of freedom subject to the general plan of operation of the system, forward this beneficial result. Thus, the result is an integral and crucial component of the system, creating an orderly interaction among all its other components.

All previously known formulations of systems built on the principle of interaction of many components. However, elementary calculations show that the simple interaction of a large number of components, such as the human body, leads to an infinitely great number of degrees of freedom. Even estimating the number of degrees of freedom only the main components of the central nervous system, but, taking into account the existence of at least five possible changes in the grading of states of the neuron [T. Bullock, 1958], you can get absolutely fantastic figure with the number of zeros on the tape length of over 9 km [P. Anokhin, 1978]. That is the simple interaction of the components are not really a factor uniting them in the system. That is why the majority of the language systems include the term "regulation". However, introducing this term, it is necessary to understand what "orders" interaction "components of the system that integrates these components into the system, which is a factor which. Anokhin (1935, 1958, 1968, 1978, 1980 and others) believes that "this factor is the result of the ordering of the system." Under his proposed concepts, only the result of the system can, through feedback (afferentation) affect the system, going with all degrees of freedom, and leaving only those that contribute to the result. "The tradition of avoiding the result of a separate physiological

category was not accidental. It reflects the traditions of the reflex theory, which completes the "reflex arc" only action, not entering in the field of view and interpret the result of this action "[P. Anokhin, 1958]. "The confusion of cause and reason and mixing action with the results disseminated in our own everyday speech," [M. Bunge, 1964]. "In fact, the physiology, not only did not make the results dei ¬ stviya matter of objective scientific analysis, but the actual contents, worked out for nearly 300 years, built on the concept of arcuate nature of the flow of adaptive responses (" reflex arc ")" [P. Anokhin, 1968]. But "the result dominates the system, and above all the formation of dominant influence the result. The result is an imperative impact on the system: if it is insufficient, then immediately the information about the insufficiency of the result is restructuring the entire system, through all degrees of freedom, and in the end, each element comes into work by their degrees of freedom that contribute to get the result, "[P. Anokhin, 1978].

"Behavior" of the system is determined primarily by its satisfaction or dissatisfaction with the result. In the case of satisfaction of the result, the body shifts to the formation of other functional system with a different result, which represents the next stage in the universal continuum results [P. Anokhin, 1978]. Dissatisfaction with the system result stimulates its activity in the search and selection of new components (based on the change of degrees of freedom of action of synaptic organizations - a critical level of functional system) and a sufficient adaptive outcome. Moreover, one of the most important qualities of biological self-organizing system is that the system in achieving the final result of continuously and actively produce bust degrees of freedom of multiple components, often in microintervals time to include those which bring the body to produce concrete with program result. Getting the system a specific result based on the degree of support it determines the ordering of components in interaction set of system components and, consequently, any component can be activated and enter the system only if it contributes its share of assistance in obtaining the programmed result. Accordingly, with respect to components of the system, more suitable term "vzaimosodeystvie" [P. Anokhin, 1958, 1968 and others], reflecting the genuine cooperation of the components of the set selected by it for a specific result. "The system can only be called a set of selective involvement of components, whose interactions and relationships take on the character vzaimosodeystviya components for focused useful result" [P. Anokhin, 1978]. That's because the conception result provides a central organizing influence on all stages of the system, and the results of its operation is essentially a functional phenomenon, the entire architecture of the system was called a functional system [P. Anokhin, 1978].

It should be emphasized that the "functional systems of the body are made up of dynamic mobilization of the structures on the scale of the whole organism and their activities and the final result did not reflect only the influence of some type of anatomical structures involved, moreover, the components of an anatomical equipment mobilized and involved a functional system only to the extent of their contribution to obtaining the programmed result "[P. Anokhin, 1978]. The concept of structure in the system leads to the understanding of how something rigidly structured deterministic. However, it is the dynamic variability of non-functional system of structural components is one of its most distinctive properties. Furthermore, in accordance with the requirements of that feature makes the structure of a living organism has an extremely important property of a sudden mobilized its structural elements. "... The existence of the result of the system as a determining factor for the formation of a functional system and its reorganization phase and the specific structure of the structural units, giving the possibility of immediate mobilization of combining them into a functional system, they say that the true body

systems are always functional in type, and this means that the "functional principle of selective mobilization of structures is the dominant" [P. Anokhin, 1978].

No less important is the fact that operational systems to ensure an outcome at this level of hierarchy, can be isolated only from the didactic purpose. Ultimately, the only full functional system is actually a living organism that exists in a continuous space-time continuum obtained by adjusting the results. Select any of the functional systems in the body in sufficiently artificial and can only be justified from the standpoint of facilitating their research. However, these "functional systems" are themselves vzaimosodeystvuyuschimi components of the integrated functional systems used by the body during its existence in the environment. Therefore, according to Anokhin's (1978), speaking on the composition of a functional system, it is necessary to bear in mind the fact that "... each functional system, taken for investigation, inevitably lies somewhere between the finest and most molecular systems high level of system organization in the form of, for example, a behavioral act. "

Regardless of the level of its organization and the number of constituent components of functional systems are essentially the same functional architecture in which the result is the dominant factor in stabilizing the organization of systems [P. Anokhin, 1978].

The central architecture of purposeful behavioral act, is deployed consistently and includes the following nodal mechanisms:
1. Afferent synthesis.
2. Action.
3. Formation of the acceptor of the result.
4. Contact afferentation (efferent synthesis).
5. Purposeful action.
6. Sanctioning phase of the behavioral act [P. Anokhin, 1968].

Thus a functional system by Anokhin (1935) is - a complete unit of any living organism, consisting of a series of nodal mechanisms that provide a logical and physiological formation of a behavioral act. Formation of a functional system is characterized by the association of private physiological processes of the organism as a whole, having the peculiar ties, relations and mutual influences at the very moment when all these components are mobilized for a specific function.

3.3.Osnovnye of the modern theory of adaptation

The human body is not something unchangeable, but even in quite short periods of time exposed to sufficient variability primarily due to its dynamically changing functional states [S. E. Pavlov, 2000, etc.], not to mention the relatively extended time gomeoreticheskoy variability of its homeostatic constants [K Waddington, 1957, 1970]. All of these physiological processes are subject to strict laws, considering the body as a whole with the environment of its existence - "the body without the external environment that supports its existence, is impossible, so a scientific definition of the body must be a member and the environment contribute to it" [IM Sechenov , 1952]. In this case it is the laws of adaptation of the human body because of its genotypic and phenotypic characteristics are decisive in the formation of some of the results of any human activity, including his work in sports [C. E. Pavlov, T. Kuznetsova, 1998; S. E. Pavlov,

1999; S. E. Pavlov, 2000].

However, before presenting the main provisions of the modern theory of adaptation [S. E. Pavlov, 2000], should again return to the theory of functional systems Anokhin (1935, 1958, 1968, 1970, 1980 and others) that underlies the theory of adaptation. In particular, according to S. E. Pavlova (2000), it is necessary to draw attention to one of the great physiologist remarks: "As an integral formation of any functional system is quite specific for its properties, which generally give it flexibility, mobility, and in some somewhat independent ¬ dence of various ready-rigid connections both within the very central system, and the scale of the entire organism "[P. Anokhin, 1958, 1968]. Herein lies the problem Anokhin, and this is the moment, which so far has reasoned factual impossibility of the actual use of the theory of functional systems in physiology and other disciplines. Anokhin (1958, 1968) has given functional property of the system is practically unlimited lability (unrestricted choice of components for the same "good result") and thus deprived of their inherent functional features of the functional-structural specificity [C. E. Pavlov, 2000].

Nevertheless, functional systems possess the property of the relative lability only at certain stages of its formation, gradually losing this property at the time of the final forming system [S. E. Pavlov, 2000]. In this case the integral function of the organism (for "external" content - its numerous behavioral acts) are very specific and "attached" to the very specific structural formations of the organism [S. E. Pavlov, 2000, 2001]. In other words, running a 100-meter distance jogging and maximum speed - two very different functional systems running, provided by the different structural components. As well as examples of different functional systems are such proplyvaniya with the same speed, but different styles of one and the same distance. Moreover, changing the parameters of any motor act, while maintaining the same end result would also indicate that "engaging" in these behavioral acts of different functional systems, "collected" from a variety of structural and functional components. However, this provision is not taken now sports teachers (otherwise they would have to radically reconsider their positions on issues of theory and methodology of sports training). So VN Platonov (1988, 1997) in defense of the concept of absolute lability of the functional systems provides data on proplyvanii competitive distance Lina Kachyushite, indicating only that the same end result can be achieved by varying the frequency grebkovyh movements. However, here Mr. VN Platonov ignored as some of the theory of functional systems Anokhin (1935, 1958, 1968, etc.), describing the features of the formation of entire functional systems of behavioral acts, as well as additions to the theory of functional systems made by VA Shidlovsky (1978, 1982) and binding to assess not only the final result, but the maximum of its parameters [S. E. Pavlov, 2000]. These provisions and amendments require the assessment of the maximum parameters of the working cycle of a functional system. An example is shown VN Platonov (1988, 1997) indicates only that the same end result can be achieved using various functional systems. Not the same thing to go to fetch water from the well in the yard or to the spring for several kilometers, although the results of these two activities - the availability of water in the house - will be the same [C. E. Pavlov, 2000].

Anokhin (1968) wrote: "it is clear that the specific mechanisms of integration, associated with certain structural edu ¬ cation, can change their characteristics and weight in the process of dynamic transformation of the functional system." In this connection it should be remembered properties of functional systems vary in the process of its formation and to recognize that in the initial stages of its formation of a functional system must necessarily be sufficiently loosely. Otherwise, the bust will be impossible to set all sorts of combinations of initially "free"

components in order to search only required the emerging system. At the same time formed a functional system should always be extremely tough and have a minimum of lability. Hence at different stages of the formation of a functional system will have different levels of lability, and the process of forming a functional system should be accompanied by a narrowing of the limits of its lability, defined entirely on the parameters of the intermediate and final results.

It may seem that the differences between different authors on the lability of the functional systems are insignificant. However, including the erroneous view on the subject does not allow VN Platonov (1988, 1997) and other followers FZ Meerson (1981) take a real physiological position in view of the nature of the process of adaptation. On the other hand principled position on the lability of the functional systems and "giving" a holistic, functional systems of absolute specificity [S. E. Pavlov, 2000] allowed to make reasonable changes in the actual theory of functional systems, to reveal the systemic mechanisms of adaptation [S. E. Pavlov, T. Kuznetsova, 1998; S. E. Pavlov, 1999, 2000, etc.] and to prove in practice [S. E. Pavlov, T. Kuznetsova, AV Afonyakin, 2001] efficiency of the proposed theory of adaptation [S. E. Pavlov, 2000].

SE Pavlov et al. (2001) outlined the main provisions of the modern theory of adaptation:
1. The basis of the adaptation process is always highly organized body formation is absolutely specific functional system (more precisely - a functional system of a specific behavioral act), adaptive changes in the components which are one of the essential "tools" of its formation [S. E. Pavlov, 2000a, b]. Bearing in mind the fact that adaptive changes in the components of the system "provided" all kinds of metabolic processes, and should support the concept of "relationship functions and the genetic apparatus [F. Z. Meyerson, 1981], identifying with that in the entire system (and even more so - in the body in general) is not always possible to talk about "increasing the capacity of the system and intensification of protein synthesis in it in the process of adaptation [F. Z. Merson, 1981], but because the principle on the basis of which the "correlation function and the genetic apparatus, in our opinion, much more properly be represented as the principle of modulation of the genome" [N. A. Tushmalova, 2000a, b].

2. System-forming factors of any functional system are finite [P. Anokhin, 1935, 1958, 1968, 1975, etc.] and the interim results of its "activities" [S. E. Pavlov, 2000], hence the need to always multiparametric assessment of not only the end result of the system [B. A. Shydlouski, 1982], but also the characteristics of the "cycle" of any functional system and determines its absolute specificity.

3. System's response to a set of simultaneous or (and) consecutive sredovye influences always specific, and non-specific link adaptation [L. J. Harkavy, EB Kvakina, MA Ukolova, 1977, 1979, S. E. Pavlov, 2000; H. Selye, 1960, etc.], as an integral component of any functional system also determines the specificity of its Response [S. E. Pavlov, 200a, b].

4. You can and should talk about co-occurring dominant and furnishing of afferent influences, but it should be understood that the body always responds to the whole complex sredovye influences the formation of a single specific to a given set of functional systems [C. E. Pavlov, 2000]. Thus, the dominant always integrated activity [P. Anokhin, 1958], implemented them in specific circumstances. But, since the final and intermediate results of this work are the backbone factors [AP Anokhin, 1935, 1958, 1968, 1975, S. E. Pavlov, 2000], we should accept that any activity of an organism is carried out very specific (emerging or formed) functional

system covering the entire spectrum of afferent influences, and that only at the moment exercise their "duty cycle" and is dominant. In the latter, we oppose the opinion of L. Matveeva, F. Meyerson (1984), who believe that "the system responsible for adaptation to physical activity, exercise hyperfunction and dominates to some extent in the life of the organism."

5. A functional system is very specific and in this specificity relative lability only at the stage of its formation (the processes of adaptation of the organism). Formed functional system (which corresponds to the adaptability of the organism) becomes the property of lability and stable under the condition of constancy of the afferent component [S. E. Pavlov, 2000]. In this we disagree with the opinion of PK Anokhin (1958, 1968, 1975, etc.), empowering the functional system of absolute property of lability, and thereby denying the functionality of their "right" of structural specificity.

6. Any of the complexity of a functional system can be formed only on the basis of a "preexisting" physiological mechanisms ("subsystems" - by Anokhin, 1958, 1968, 1975, etc.) which, depending on the "needs" a specific integrated system, may be involved or not involved in it as its components. It should be understood that the components of a functional system is always structured software features a "subsystem", the idea is not identical to the traditional notions of anatomical and physiological systems of the organism [P. Anokhin, 1958, 1968, 1975 and others].

7. The complexity and length of the "cycle" functional systems has no boundaries in time and space. The organism is able to form functional systems, the time interval "cycle" which does not exceed fractions of seconds and with the same success can "build" system, with hourly, daily, weekly, etc., the duty cycle. The same can be said about the spatial parameters of functional systems. However, it should be noted that the more complex the system, the harder it is installed in it between its individual elements in the process of its formation and that these ties and then weaker, including those formed in the system [S. E. Pavlov, 2000].

8. Obligatory condition of the full formation of any functional system is the consistency or frequency of action (during the period of implementation of the system) on the body of the standard, unchanging set of environmental factors, "providing" as a standard component of the afferent system [P. Anokhin, 1958, 1968, 1975 and others; S. E. Pavlov, 2000].

9. The process of adaptation, despite the fact that it proceeds according to general laws, is always individual, as is directly dependent on the genotype of an individual, and implemented within this genotype, and in accordance with the terms of the previous life of the organism's phenotype [C. E. Pavlov, 2000]. This necessitates the use of research in studying the processes of adaptation primarily the principle of individual approach.

The absolute specificity of the integrated functional systems - functional systems of specific behavioral acts - defined as the absolute specificity of the structural components of these functional systems [S. E. Pavlov, 2000], vzaimosodeystvie [P. Anokhin, 1958, 1968, 1975 and others], and which ensures the implementation of these behavioral acts. One of the mechanisms that support the specific relationship between the components of a particular functional system during the "execution" by the organism specific behavioral act is a mechanism aimed haemocirculation redistribution favoring the provision of components involved in this system [C. E. Pavlov, 2000; Pavlov, Z. Ordzhonikidze, T. Kuznetsova, 2001]. Moreover, it is logical

to assume that the level of blood supply to each of the functional components of the system depends on the "shares" of the component in a specific functional system. The selectivity of the blood supply components of functional systems - is not the only mechanism for determining and "inside" the specificity of behavioral acts, but he can rightly be reckoned among the "core". And not only that the blood (or rather - of red blood cells) is a "means" delivery to working tissues of oxygen. Blood carries "transport" functions as a whole, ensuring delivery to the tissues of the body a huge amount of "substrate" necessary for his life in different environmental conditions. But the "points" and "size" delivery of all these "substrates" (including oxygen) is always and in each case is determined by the functional system, its absolute specificity. So when it comes to including the motor acts of body, should be clear that there is no "movement in general, and any motor act is very specific. There are specific functional systems, with specific parameters and the outcome of the process of motor (and more widely - behavioral) acts which, in turn, may become components of the myriad of more complex behavioral acts with their result and the process parameters. In this regard, each functional system is already taking concrete shape with the physiological tough enough (within the defined its lability) structure. That is why athletes have qualified the maximum values of oxygen consumption in the form of locomotion, in which they practice [E. L. Fox, D. K. Mathews 1981; R. T. Withers, V. M. Sherman, J. M. Miller, D. L. Costill, 1981], the same subjects, maximum oxygen consumption, reached in a stepped TEN ¬ are less than the same figure - the test, keeping the critical velocity ¬ tion "[DW Hill, CS Williams, SE Burt, 1997] in the performance of athletes, non-specific exercises for their maximum oxygen consumption are lower, even with greater muscle mass involved in [EB Myakinchenko, 1997]. VP Savin (1985), who studied "the interdependence of indicators of physical development indices individual varieties techniques of movement on skates, skilled hockey players led evidence about the actual lack of correlation (r = 0,046) in skating in a straight line with the index running without skates. According to the VA Geselevicha (1991, 1997) have qualified athletes "... indicators of physical performance are significantly lower due to the closeness ... the level of specially trained, compared with nesportsmenami." NZ Bulgakov et al. (1996) wrote that when a comparative assessment of indicators of lung function in swimmers during swimming veloergometricheskogo and testing the first version of the test (more specific to these athletes) marked hypoventilation (difference - 20-45%), and the levels of maximum oxygen consumption at the swimmers received at swimming test is higher than when running on a treadmill or "paper" on bicycle. LL Golovina et al. (1998), who studied the effects of endurance training in preschool children, based on motor tests and comparing their results for boys and girls concluded that, in particular the component of force "(" power performance of boys in the greater increase in the training process ... ") in children to a small extent used in the process of implementation to run on the stamina and speed." According to AB Trembach, VV Marchenko (2000) "thrust force load the same amount in weightlifting ... substantially affect the electrical activity of muscles of the shoulder. "

What a specific motor acts undertaken by an athlete during training, as specific recovery processes occurring in a particular organism, commit or have committed a specific motor act, or a certain amount of motor acts. That is, as no motion at all, so there can be no "recovery at all." Just as no activity at all, and no training at all "- there is a specific scrimmage work done by individual athlete in specific circumstances. By the way with these items should be declared "illegal" to exist in sports pedagogy, medicine and physiology of the term "general physical performance." Efficiency, as well as the work itself, performed by a specific organism, absolutely specific. In this connection it should be recognized, at least incorrect attempts to sports teachers, doctors and psychologists to assess the level of the special performance of athletes on

the results of non-specific for them loading tests [C. E. Pavlov, T. Kuznetsova, 2000; S. E. Pavlov, 2000; S. E. Pavlov, ZG Ordzhonikidze, IV Afonyakin, T. Kuznetsova, SM Nikitin, VV Aseev, 2001; I. Afonyakin, T. Kuznetsova, N. Chistov, Pavlov, 2001].

Pavlov, SE (2000) made a partial objection to the principles of the FZ Meerson (1981) and his followers and declares "the relationship function and the genetic apparatus. By the way: priority in the "discovery" of this principle, implicitly loaned FZ Meerson his numerous fans and followers of the questionable - even Hunter in 1874 suggested that each part of the body increases as a result of the physiological requirements for function of this part; about link function and reparative regeneration described in the works of researchers who have studied this process in mammals [M. A. Vorontsov, 1949, 1953; AN Studitskii, 1962], according to the same FZ Meerson (1981), "... work that demonstrates the dependence of the genetic apparatus in muscle cells of healthy people on their level of physiological function, was performed R. Zach [R. Zak, 1962], who compared the function of three different muscles with the intensity of protein synthesis and RNA content in muscle tissue, and similar results were obtained by A. Margreth, F. Novello (1964), who showed that "... the concentration of RNA, the ratio of protein and RNA, and intensity of protein synthesis in different muscles of the same animal are directly dependent on the function of these muscles [F. Z. Meyerson, 1981].

By the way: the above principle, built his "author" in the highest degree is in who espoused his theory of adaptation (adaptation - deadaptatsiya - readjustment ") represents a linear, mechanistic and overly simplistic approach FZ Meerson to the study of adaptive processes, even at the cellular level [S. E. Pavlov, 2000]. In the body as a whole (in its various tissues and organs) may proceed simultaneously quite differently directed processes defined realized in the phenotype genotype, sredovye conditions and specific activities undertaken by a specific organism. These conditions are crucial in obtaining a certain end result of any (including athletic) of human activity. If conditionally distinguish them from the specifics of the operations, it is possible with the same degree of conditionality to say what it primarily determines the specificity of adaptive changes in the human body. That is, contrary to NI Volkova (1986): given by between physical exercise and achievable training effect is always one correspondence caused exclusively by laws of physiology. And, incidentally, is the knowledge of the physiological laws can not agree with the opinion of today's N. and Volkov et al. (2000), shows that "adaptation to the effects of physical activity is under the general biological law, described by the dose - effect" and reflects the general tendency today to judge the adaptation process exclusively with non-specific items [C. E. Pavlov, 2000].

The body always responds to a coherent set of sredovye influences and his reaction to this current set are always a single systemic [S. E. Pavlov, 2000]. This excludes the possibility of cross-sectional dominance of several functional systems [P. Anokhin, 1958]. It should be understood that the function and structure are one, and this excludes afiziologicheskie presentation about some "cumulative" [N. Volkov, 1986; LP Matveev, 1997; and others] processes in the body, are the basis of future structural changes ["structural footprint" - FZ Meerson, 1981; FZ Meerson, M. G . Pshennikova, 1988; VN Platonov, 1988, 1996; AS Solodkov, FV Sudzilovsky, 1996; and others] in its tissues and organs. Next: according to the basic tenets of the theory of functional systems [P. Anokhin, 1935, 1958, 1968, 1978, 1980, etc.] the final

formation of a specific functional system (which corresponds to the achievement of adaptability of the organism to a specific set of actions it sredovyefactors - S. E. Pavlov, T. Kuznetsova, 1998; S. E. Pavlov, 1999, 2000) is only possible with long-term (during the adaptation period), permanent, and periodically or aperiodically repeating the action of complex environmental factors. One of the conditions of the possibility of achieving the body of adaptability to such a complex - the relative immutability of the complex. "... The system created by the fact that every day is repeated stereotyped order of the same conditioned stimuli" [P. Anokhin, 1978]. And besides, a functional system can be formed only if the changed conditions of existence of the organism are adequate to its adaptive capabilities. It is obvious that if certain changes in the environment, will produce excessive demands on the body and can not be compensated for its place in the adaptive changes, then the organism when it is impossible to avoid the "interaction" with this changed environment simply die.

Pavlov, SE (2000) gives the following definition of adaptation: "Adaptation - is a continuous process of specific adaptation of organisms to constantly or periodically changing conditions of its existence, which provides system reactions in response to complex sredovye exposure." Moreover, in his view, the process of adaptation always occurs on the principle of formation of an integrated functional system of the organism. The basis of the adaptation process in the opinion of SE Pavlova (2000) on the one hand are "adaptive reaction of the organism -" functional "specific system's response to complex sredovye" effects, in which non-specific components, to define the expression of specific reactions, making their contribution to the specificity of "reacting" to this complex functional system "[S. E. Pavlov, 2000], on the other - "adaptive changes - structural adjustment in the components of a particular functional system, help to restore the homeostatic balance of the organism, which occurred due to the shift in the homeostatic constant components of the system and is one of the mechanisms of formation of this system [C. E. Pavlov, 2000]. It is stated on the absolute (although heterochrony) relationship "function" and "structure" [D. S. Sarkisov, 1982; SE Paavlov, 2000], which gives no right to assume that the adaptive response and adaptive changes - some separately occurring in the body processes.
Process of adaptation, subject to the above conditions occurs phasically:
1. Stage of primary emergency mobilization of pre-existing components.
2. Phase selection of the necessary system components.
3. Stage of relative stabilization of the component composition of the functional system.
4. Phase stabilization of a functional system.
5. Stage narrowing afferentation [S. E. Pavlov, 2000].

4.Fiziologicheskie basis trenirovannosti.

"Fitness" - Pedagogical term used primarily in sports practice. In connection with this assessment "level trenirovannosti" - is the prerogative of the teacher in the basis of which should be based on proper assessment of the dynamics of athletic performance of an athlete. That is precisely the result, but not certain (even if assessed as positive!) Changes in physiological systems and organs determines the level of trenirovannosti. And at the same time - always in comparison with the previous achievements of a particular athlete. But if you remember: it is the result of a system-forming factor. Thus the basis for achieving an athlete as possible (at the moment of his body) level trenirovannosti (achieving "peak fitness") should be

based on the construction of a specific functional system of a specific motor act [C. E. Pavlov, T. Kuznetsova, 1998; S. E. Pavlov, 1999, 2000a, b; S. E. Pavlov, MV Pavlov, T. Kuznetsova, 2000], which corresponds to the achievement of the status adaptability to a strictly defined a coach, but the physiologically based training load [S. E. Pavlov, 2001].

Conclusion

Only the uninitiated, or the person near it may seem that the study of mechanisms of adaptation problem exclusively physiological. Really working laws and principles of adaptation cannot be ignored in practice, such as pedagogy (including sports), medicine, psychology and other scientific and practical directions, which is the focus of attention of Man in his complex relationship with the environment.
In recent years the attention of representatives of natural science areas of the world scientific community is focused primarily to address a variety of special problems of physiology and medicine. Of course, the genome may allow the science and practice to reach a qualitatively new level, but without the knowledge and mastery of the principles according to which the whole organism is the implementation of the genotype in the phenotype of this "programmed" the global scientific community discovery (as well as any "private" discovery in physiology and medicine) prepared for the role of "things in themselves", or, at least, neither in science nor in practice cannot be used all its potential.

However, remember that any theory - is not a set of laws in final form, but first and foremost principle is intended to streamline the accumulated experimental data to answer the challenges facing practitioners and theorists of the issues and to formulate new questions, possibly pointing the way for their possible solutions. And as I said Anokhin (1971): "Hypotheses are aging, and if they persist, it calls into question their legitimacy.

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