Modern Theory and Practice of Coaching for Sporting Excellence

S. E. Pavlov, A. S. Pavlov, A. A. Petrov
With A. Squillante
Edited By Steve Gunn

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Reviewer: Academician of the Russian Academy of Education, Professor, Doctor of Pedagogical Sciences Sergey Neverkovich

Editors: Petrov Alexander, lecturer of Russian State University of Physical Education, video coach of Russia's national women hockey team; Kirill Proskurin;

This book is addressed to sports coaches and professionals involved in providing training to qualified athletes. Authors of the book declare that the training of athletes is essentially a physiological process and that the results of any human activity are determined by the systemic laws of functioning of the human body. The laws of adaptation of the human body, the laws of cross-adaptation, and the principles of achieving compensatory and extra compensatory states by the body, which underlie the increase in athletes' sports performance, are described. The "classical" ideas about the principles and methods of training qualified athletes were criticized. The modern principles of sport training and individual methods of constructing training periods for qualified athletes are presented. Means and methods that can be used in the complex training of qualified athletes are described.

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INTRODUCTION

Each athlete is a "product" of the professional experience of his or her coach, whose knowledge and skills determine the quality of this "product." The modern level of sporting achievement creates demands on the professional knowledge and skills of specialists involved in the training of athletes. At the same time, it should be known that the the long-term process of training an athlete, from youth sports to the highest levels, is largely conditional, because mistakes made by coaches at any stage of this path can keep the athlete from reaching full potential.

Sports specialists should understand that the object of their activity is the human body and its complex relationship with the environment, and that the laws of physiology are the only ones on which the theory and methodology of sports can be based on. An athlete in all the diversity of his or her life manifestations is a part of nature, subject to its laws. That's why the goals of any individual athlete can only be realized if his or her actions are based on knowledge of the laws of nature. Human sports activity cannot be an exception to the rule. At the same time, the athlete's body is a special mechanism, functioning according to general physiological laws, but always in accordance with the specifics of his main sports activity, which inevitably makes significant training adjustments necessary. Thus, the long-term training of an athlete is an initially physiological process, and then a pedagogical one.

The skill of a coach depends, firstof all, on the depth of his or her professional knowledge, and on his or her ability to use this knowledge in the work environment. The coach is obliged to possess modern knowledge in his

or her profession. Furthermore, educators who teach coaches need to learn the text from the poster in front of the entrance to Stellenbosch University (South Africa): "The destruction of any nation does not require the use of atomic bombs or the use of long-range missiles. Only a decrease in the quality of education is required! ..."

I. LAWS OF FUNCTIONING AND ADAPTATION OF THE HUMAN ORGANISM - THE BASIS OF MODERN THEORY AND PRACTICE OF SPORT

The laws of adaptation determine the results of any human activity, including sports activities. A majority of sports theorists have mentioned the role of adaptation processes in human sports activity. Among them are V. M. Zatsiorsky, N. N. Yakovlev, L. P. Matveev, A. N. Vorobiev, Y. V. Verkhoshansky, V. K. Balsevich, V. N. Platonov and others. Of those scientists, one who deserves particular attention is N. N. Yakovlev, who back in the 1970s stated that in order to really control the training process, it is necessary to know the laws of adaptation of the human body. The well-known physical culture theorist L. P. Matveev tried to state the role of adaptation processes in sports training in an article written jointly with the famous adaptology specialist F. Z. Meerson. This did not prevent L. P. Matveev from later repeatedly denying the real significance of adaptation processes in training athletes.

The basis of the sports and pedagogical process are the laws of development and adaptation of the human body. It is on the basis of these laws that the general theory and methodology of sports, and the theory and methodology of specific sports, should be created. In general, the laws of development and adaptation of the human body, the general theory and methodology of sports, and the theory and methodology of specific sports are the foundation on which the actual sports and pedagogical processes should be based on, as well as additional areas (biomedical and psychological) of training athletes (Drawing 1).

Drawing 1. Unity of the component parts of the process of training and preparing athletes (S. E. Pavlov, T. N. Pavlova, 2011).

The laws of development and adaptation of the human body are the physiological basis of sports training. Unfortunately, the laws of development of the human body have not yet been described by anyone. S. E. Pavlov described the real laws of adaptation of the human body. However, the overwhelming majority of "sports theorists" use initially absurd ideas about the principles of adaptation of the human body. That is why the general theory of sports, and the theory and methodology of specific sports, have not yet been created. Not a single country in the world has created working systems of medical, biological and psychological support for the training of athletes.

The concepts of "homeostasis" and "stress" underline the dominant concepts of adaptation today.

The term "homeostasis," in translation from ancient Greek, means "immovable constancy." The author of the idea of the constancy of the internal environment of

the body is the French scientist Claude Bernard (1813-1878). Obviously, the level of development of biological science in the 19th century did not allow C. Bernard to understand that in the human body there is not a single constant on which he could rely.

Claude Bernard's ideas were taken up by Walter Cannon (1871-1945), who stated that the "wisdom of the body" is in "homeostasis," and that the constancy of the internal environment of the organism is what the organism "relies on" in its adaptation to the conditions of existence. However, Cannon, in the twentieth century, already had to know that the internal environment of the body is unstable!

The concept of homeostasis does not stand up to elementary criticism. In the internal environment of the human body there is not a single real constant on which this or that physiological process can rely, and all indicators of the state of the internal environment widely changeable.

To characterize the state of the internal environment of an organism, the term "homeoresis," proposed by Conrad Hull Waddington in 1957, is more suitable and accurate.

The principle of homeostatic equilibrium can be represented as a ball on a flat, stable surface. In the principle of homeoresis, the surface is not flat and not stable. The concept of homeoresis predetermines a fundamentally different, much more complex relationship between the state of the internal environment of the organism and its adaptive reactions and changes.

However, the concept of homeoresis was for some unknown reason ignored by the world's scientific commu-

nity. That makes no sense, because homeoresis is directly related to the theory and practice of sports and explains why the human body can react to the same load differently. Moreover, this concept largely predetermines the principles of building the training process.

It is believed that the consequences of the stress reaction of the body were first described in 1936 by H. Selye, who killed laboratory animals in various ways, and then, upon opening their bodies, found similar changes in their organs. The triad of these changes, arising in response to influences leading to the death of the body - an increase in the adrenal cortex, involution of the thymus, the appearance of ulcers in the stomach and duodenum - was named "general nonspecific syndrome" and later simply "stress." In fact, all these symptoms of stress were discovered by different scientists in different countries back in the 19th and early 20th centuries.

Selye later defined real stress as "any disruption of the normal functioning of the body," and millions of scientists around the world believed him and became voluntary distributors of these absurd ideas. In fact, Selye made a scientific forgery, crossing out the real results of his own research and combining all nonspecific reactions of the body under the single term "stress." However, he achieved what he longed for all his life - worldwide fame!

Soviet scientists M. A. Ukolova, L. H. Garkavi and E. B. Kvakina proved in the early 1960s that the human body reacts differently to different impacts. They described the body's reactions to weak, medium and excessive impacts (stress). Their studies were truly unique! By controlling the nonspecific adaptive reactions and reactivity of the body, these scientists discovered ways to effec-

tively combat diseases that are still considered incurable or difficult to cure. However, their knowledge turned out to be too complicated for doctors who want to receive ready-made recipes for treating diseases, according to the principle of "take 1 tablet, 3 times a day!"

In studies conducted later by Soviet researchers under the leadership of F. Z. Meerson, it was found that stress is also characterized by persistent damage to the heart muscle, which remains even after the stress itself has passed. One of the conclusions that can be drawn from the research is that sports theorists who argue that it's necessary to increase athletes' stress loads, with coaches who drive athletes into stressful conditions, are criminals! They are to blame for the numerous deaths of initially healthy athletes.

Someone once invented, and others thoughtlessly picked up a phrase about stress - "What does not kill us makes us stronger!"

In fact, when it comes to stress, what doesn't kill us quickly kills us slowly! This statement stems precisely from the research results of F. Z. Meerson and employees of his institute.

Soviet scientists developed methods for diagnosing nonspecific reactions of the body, and the very doctrine of these reactions was formalized into the theory of the non-specific link of adaptation.

The theory of the non-specific link of adaptation can be effectively used in the practice of sports. In 1989, T. N. Kuznetsova applied this methodology for assessing the nonspecific reactions of athletes' organisms, and predicted with a 100% probability the success or failure of swimmers of different ages and qualifications at various

competitions. Kuznetsova additionally highlighted the body's reactions to excessive loads while not reaching a stressful level. In a study conducted with 125 highly qualified swimmers, it was found that the percentage of stress conditions in this group during training did not exceed 1.6%. However, the number of swimmers who were exposed to excessive loads was 50.4%. Evaluation of the same nonspecific reactions of swimmers immediately after the competition showed an increase in the number of stressful conditions up to 3.2%, but a decrease in the number of overloaded swimmers to 34.2%. Assessment of the percentage component of stressful states in swimmers indicates that stress does not play a positive role at all in the sports and pedagogical process. The trainers called Kuznetsova a "witch" because of the absolute accuracy of her predictions. yet the results of her research are still not used in the practice of training Russian athletes. This is largely due to the categorical rejection by "sports theorists" of modern knowledge about the laws of functioning and adaptation of the human body. According to the conclusions from the research results of Kuznetsova: the growth of sports performance is based not on stress loads, but on training loads that are optimal and correspond to the adaptive capabilities of the athlete's body.

On the basis of Selye's "stressful" ideas, someone invented the "formula" of the adaptation process – stress, adaptation, disadaptation, readaptation. But numerous scientists, stupidly advertising this formula, did not bother to understand the following:

1. Nonspecific characteristics (sizes) of factors acting on the organism cannot be considered in isolation from the specific qualities of these factors. And the body cannot

react separately to the non-specific and specific properties of the acting factors! But there are no specifics in the above "formula" at all. And neither stress nor other non-specific reactions of the body can independently trigger mechanisms of the adaptation process.

2. "Disadaptation," in the minds of the majority of scientists, is a process opposite to adaptation and its destruction, which is generally possible only in connection with the death of an organism. In addition, the use of the term "disadaptation" is associated with the idea that adaptation as a process that occurs periodically. But adaptation is a continuous process that lasts throughout the life of an individual. One more thing - the emergence of the term "disadaptation" is associated with the idea that adaptation is always the result of some ideal opportunities provided to the body. But this is not so! The body adapts to its conditions of existence. If these conditions place increased demands on the capabilities of the body, then the body tries to adapt to these conditions. By the way, stress ensures the destruction of structures and functions of the body, not their creation!

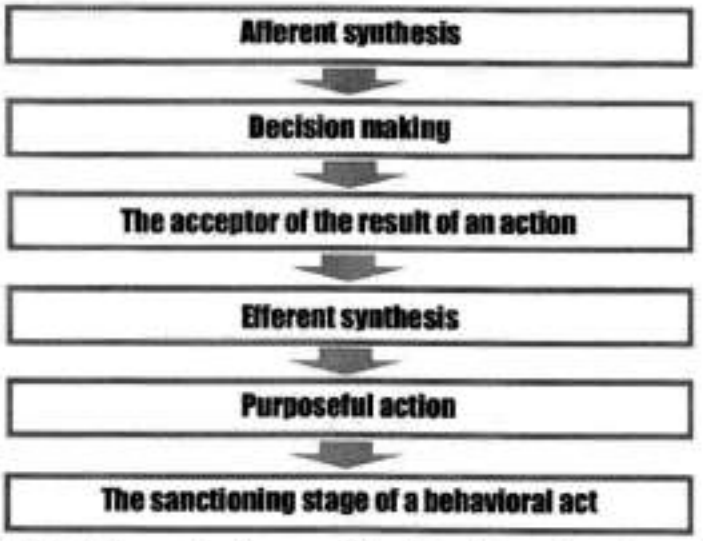
3. The process of "readaptation," according to the majority of scientists, means the return of the organism to the previously achieved level of adaptation. But remember, you cannot enter the same river twice! An organism is changeable - this is its inalienable property - and therefore all subsequent adaptation cycles (which can be distinguished only conditionally) will not result in a return to the "previously achieved level of adaptation," but a movement toward new levels of adaptation, which are not obliged to exceed those previously achieved.

Thus, the "formula" - "stress, adaptation, disadaptation, readaptation" - is absolutely illiterate and absurd from start to finish, and in no way reflects the real processes occurring in the body during its adaptation to the environmental factors continuously acting on it.

All "classical" physiology was built on the theory of the reflex arc by Rene Descartes, which was proposed in the 17th century. However, the reflex arc theory does not explain the mechanisms of all complex adaptive reactions of the organism!

The real laws of adaptation of the human body are fundamentally different from the absurd ideas about adaptation, which are used today by sports theorists and practitioners. These laws are based on the systemic principles of the functioning of the human body. One of the first articles revealing these principles was published by P. K. Anohin (a disciple of the great Russian physiologist I. P. Pavlov) in 1935 - a year earlier than Selye published his message about the "general adaptation syndrome". But Selye, in contrast to academician P. K. Anohin, had the broadest opportunities to advertise his discovery, which he used all his life. And the ideas of Anohin turned out to be too complicated for the majority of scientists.

The central factor that creates a functional system is the result of its work. But:as Anohin wrote, "Physiology in all centuries has ignored the result as a real physiological phenomenon!" All functional systems (purposeful behavioral acts) of an organism have the same architecture, which develops sequentially and includes the following nodal mechanisms (Drawing 2):



Drawing 2. Nodal mechanisms of the functional systems of the body (P. K. Anohin, 1935, 1958, 1968 and others).

Afferent synthesis (afferens-bringing;, synthesis-connection, composition) - the process of juxtaposition, selection and synthesis of numerous afferentations – is caused by various effects on the body. This process takes place in the central nervous system, and as a result of this process the goal of the forthcoming action is formed.

Decision making is the choice by the brain of a strategy for the behavior of the organism as a whole in the current situation.

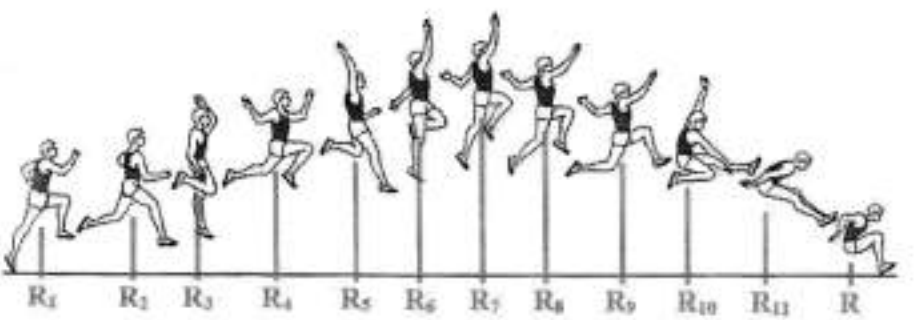
The acceptor of the result of an action is a physiological apparatus for foreseeing and evaluating the results of an action. The acceptor of the results of an action is a complex group of advanced excitations in the central nervous system, worked out in the process of afferent synthesis.

Efferent synthesis is a stage in the functioning of a system that precedes purposeful action and represents a complex series of specific excitations in the central nervous system and peripheral apparatuses of the body.

Purposeful action is a behavioral act (more narrowly, a motor act) aimed at achieving the desired result of an action.

The sanctioning stage of a behavioral act is the process of comparing the result of an organism's action with a "programmed" result (a previously formed acceptor of the result of an action) and assessing the sufficiency or insufficiency of the result obtained.

However, P. K. Anohin made a mistake in his theory of functional systems, endowing functional systems with the property of absolute liability of their components. He argued that it doesn't matter how the body obtains the desired results. But for the body it makes a significant difference if you get the desired results by getting them directly or by adding "extra" steps on the way. For the body, not only the end result of the work of a specific functional system (behavioral or motor act) is important, but also how this result was obtained! S. E. Pavlov stated that the intermediate results of the work of each specific functional system are absolutely significant for the body, and in this regard, it is necessary to evaluate not only the final, but also the intermediate results of the system's work, as well as the maximum of their characteristics (Drawing 3).



Drawing 3. External structure of a part of the functional system of a competitive motor act (S. E. Pavlov, A. S. Pavlov, T. N. Pavlova, 2019, 2020).

Such an understanding of the principle of the functioning of the body's systems narrows the components of these systems to real boundaries, determines the structural-functional specificity of each system and how it is directly related to sports activity. Any competitive motor act can be described by its intermediate and final results and specific motor characteristics.

Thus, according to the theory of functional systems by P. K. Anohin, and finalized by S. E. Pavlov, the functional systems of the body are its numerous specific behavioral (motor) acts, characterized by their intermediate and final results. The formed integral functional systems of the organism - its specific behavioral acts - are characterized by the absolute specificity of the structures and functions that provide these working acts. Thus, any activity of the organism is absolutely specific in its functional, structural, energetic and other characteristics. But in the process of the formation of functional systems of the body, the shares of certain structures and functions that comprise them, the contribution of these structures and functions to the work of the system, and the structures and functions themselves must necessarily change, and this is the essence of adaptation processes.

The head of the Department of Sports Physiology of the Moscow State Academy of Physical Culture (MGAFK), Professor V. S. Fomin, wrote back in 1984 that in the process of training, a specific functional system is developed and consolidated, which is implemented in sports activities. But this statement was completely ignored by the sports teachers of both the Moscow State

Academy of Physical Culture and all other sports higher educational institutions of Russia.

Modern provisions of the theory of functional systems were the basis for S. E. Pavlov's 2010 description of the actually operating laws of adaptation of the human body:

1. Adaptation is a continuous process that stops only in connection with the death of the organism.
2. The process of adaptation of the organism cannot be described linearly, since in various structures of the organism, multidirectional metabolic processes occur every second.
3. The process of adaptation of the human body is always based on the formation of specific functional systems (specific behavioral acts), adaptive changes in the components of which serve as one of the obligatory "tools" for their formation.
4. The backbone factors of any functional system are the intermediate and final results of its activity.
5. Systemic reactions of an organism to any complex set of environmental influences are always specific, and the nonspecific link of adaptation, being an integral component of any functional system, also determines the specificity of the response of a given organism.
6. The body always reacts to the whole range of environmental influences by forming a single functional system specific to this complex.
7. Each functional system has the property of structural and functional specificity and, within the framework of this specificity, is relatively changeable only at the stage of its formation.

8. Any functional system of any complexity can be formed only on the basis of pre-existing physiological mechanisms, which, depending on the needs of a particular integral system, may or may not be involved as its components.
9. The complexity and length of the "working cycle" of functional systems has no boundaries in time and space.
10. A prerequisite for the full-fledged formation of any functional system is the constancy or frequency of action on the body of a standard, unchanging complex set of environmental factors.
11. A prerequisite for the formation of any functional systems is the participation of memory mechanisms in this process.
12. The adaptation process proceeds according to general laws, but it is always individual, since it is directly dependent on the genotype of a particular individual and the nature of his previous life.

The basic concepts that are used in the description of the laws of adaptation are the following: "Acting factors of the Environment," "adaptive reactions of the organism," "adaptive changes of the organism," "adaptation of the organism," "adaptation results of the organism" and "the level of adaptability of the organism".

The operating factors of the environment are a voluminous, complex concept that includes all factors that actually have specific effects on the body.

Adaptive reactions of the organism are specific reactions of the organism, its urgent response to the complex acting factors of the environment.

Nonspecific adaptive reactions of an organism are an artificially isolated link of adaptation, which makes it

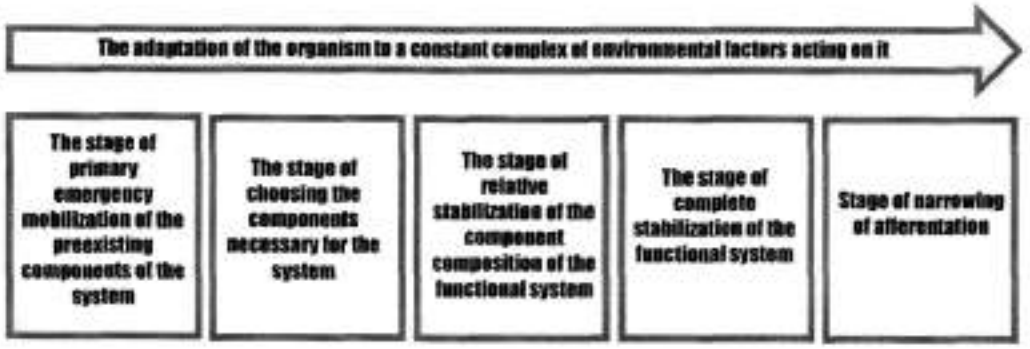
possible to assess the true (reflected in the reactions of the organism) size of the many environmental factors acting on the organism.

Adaptive changes are specific changes that occur in the body in the process of its adaptation to the complex environmental factors acting on it.

Adaptation of the organism is the process of specific adaptation of the organism to the factors of the environment that are always acting on it in a complex manner , taking into account its adaptive capabilities and the process of maintaining the structural and functional stability of the finally-formed functional systems of the organism.

The adaptation results of the organism are the absolute result of the adaptation process - the state of a specific dynamic balance of the organism, formed as a result of a prolonged interaction with a constant stream of environmental factors acting on it.

The level of adaptation of the organism (the level of training in sport) is the state of the organism, assessed multi-parametrically at any stage of its adaptation to the complex factors of the environment acting on it.



Drawing 4. Stages of the adaptation process (S. E. Pavlov, 2010)

The process of adaptation of the organism (the process of formation of specific functional systems) under the condition of constant or regularly repeated actions of a standard set of factors proceeds in stages:

1. The stage of primary emergency mobilization of the preexisting components of the system. 2. The stage of choosing the components necessary for the system. 3. The stage of relative stabilization of the component composition of the functional system. 4. The stage of complete stabilization of the functional system. 5. The stage of narrowing of afferentation. (Drawing 4).

The implementation of all stages of adaptation is possible, provided that the multitude of environmental influences on the body remain unchanged throughout the entire adaptation period. A change in any component of the influences acting on the body throws the body back to the initial stages of adaptation.

A.S. Pavlov, a specialist for the hockey club CSKA (Moscow, Russia), analyzed the systemic laws of adaptation in one of his books and made the following conclusions, which are of paramount importance for sport:

1. The body always works as an integral mechanism and forms motor acts in strict accordance with the conditions in which it exists. 2. Any activity of the organism is extremely specific, both in terms of its external parameters, and in terms of the structural and functional characteristics of the work of the organism carrying out this activity. 3. Adaptive changes in an athlete's body always correspond to the total specificity of the training activity carried out by him. 4. Stable systems of specific motor acts are formed as a result of multiple standardized repetitions of specific movements.

The law on the structural and functional specificity of specific behavioral (motor) acts of a person negates the very possibility of the existence of abstract "physical qualities" of the organism. There are no separate "physical qualities!"

Any motor act of a person can always be described by a complex set of inherent motor characteristics. A coach, together with an athlete, must build a single target functional system (or a set of functional systems) of a competitive motor act (or a set of competitive motor acts) - with a sport result available to the athlete at this stage of his development.

A coach who trains highly qualified athletes should always rely on the systemic laws of functioning and adaptation of the human body, and not on the ideas of "sports theorists" who are divorced from physiological realities. The training process should not be aimed at the development of non-existent "physical qualities" in athletes, but at increasing the level of their special training and sports performance.