Academician I. V. Davydovskiy on pathology, physiology and biological fitness of the organism for adaptation, ecology and environmental fitness of the functional systems involved in the process of adaptation

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Abstract. Ippolit Vasilyevich Davydovskiy (1887-1968) is the largest Russian pathologist and Vice-President of the Academy of Medical Sciences of the USSR. He has developed the problems of infectious diseases, the pathogenesis of sepsis, wound complications, atherosclerosis and in the decline of years – gerontology, the problems diseases causation and health maintenance. Pathology is the field of biology, which studies life disorders arising because of insufficiency of adaptive reserves. The state of the adaptive mechanisms of the organism causes the transformation of the pathological into physiological and back. Ecology is the field of biology, which studies the adaptive processes of the organisms to the impact of the environment, studying the principles of natural selection and self-preservation of the biological species. Activity of the adaptive responses reflects the biological fitness of the organism to adapt, ecological fitness of the functional systems involved in the process of adaptation, the possibility of self-preservation and evolution of the organism.

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Introduction

The academician and Vice-President of the Academy of Medical Sciences of the USSR, I. V. Davydovskiy (1887-1968) has been developing the problems of pathological anatomy, infectious diseases, the pathogenesis of sepsis, combat trauma, wound complications, atherosclerosis and in the decline of years in– gerontology, the problems diseases causation and health maintenance. According to I. V. Davydovskiy, the most important cause for transformation of the physiological processes into pathological ones is the insufficiency of adaptive reserves, environmental "failure" of the body "to integrate" in the living environment [1]. This dramatically reduces the chances of self-preservation of the organism: the labor activity, social significance, level of individual health and span of life are reduced. That is why, in order to maintain health in the changing environment, the relevance of search of the methods to increase the capacity of organism adaptation, "refinement" of the body in the living environment increases. Many scientists have studied these tasks in the twentieth and twenty-first century, including [2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13].

Main points

Speaking about pathological mechanisms, I. V. Davydovskiy notes [1] that pathology is a broad area of biology, which studies the manifestations of life disorders and deviations from the norm. Every time specific integrity (individual, health, illness, maturity, longevity, etc.) is reproduced a new way due to a huge number of interrelated manifestations (species, genetic, age, sex, social, etc.) and their respective interactions with the internal and external factors. That is why determination of the mechanisms of pathological processes requires not only medical knowledge, but also the knowledge of other sciences, especially biology, chemistry, physics and mathematics. Knowledge integration is important, as almost invisible factors of evolution, which cause body reactions, produce changes not only in the area of physiology and morphology, but also in the area of pathology and nosology.

A leading place, among the factors of evolution, is taken by adaptation - *specific and individual adaptability to environmental factors*. This is environment, which in the course of evolution *forms specific and individual variability*, and thus the foundations of health, pathology and nosology. Physiological responses are like a kind of a dynamic and morphological stereotype and its turning into a pathological stereotype is not just a "dysfunction" or "damage", but only the adaptation of the physiological functions to these conditions of existence. Both, physiological activity and pathological forms of body responses are typical. That is why diversity of life phenomena does not allow demarking the concepts of "health" and "disease" scientifically and objectively.

The idea of essential separateness of physiological and pathological processes is quite widely distributed, but it is not true. It is not logical

to oppose compensation (as physiology) to decompensation (as pathology) because there is subcompensation between them. Besides this, almost all pathological processes have their prototypes in physiology. Thus, degeneration, necrosis, atrophy, bleeding, thrombosis, regeneration and even tumor are observed not only in pathology, but also in the physiological life. The notion of compensation reflects full eurhythmy in the operation of the functional systems of the body from the cell level to the level of the whole organism, the strength of its balance under the conditions of continuous environmental impacts. Decompensation is the loss of eurhythmy in the work of functional systems. It can be subjectively perceived or non-perceived, as the counter and permanent compensation process corrects it. But if compensation (physiology) turns into subcompensation or even decompensation (pathology), adaptive properties are not always lost by the body: for example, a patient with cardiac sub- or even decompensation can live for years.

In the pathological mechanism, there are distinguished two separate processes: on the one hand, the process of "dysfunction", which is a manifestation of a disease (pathology) and on the other hand - the process of action of "protective physiological mechanisms", which represent a physiological measure against the disease. Thus, it is the state of the protective physiological mechanisms of the body, which makes the person a certain modus in rebus, the transformation of pathological in physiological and back. All these are compensatory-adaptive processes from the standpoint of biology. They are quite individual in their manifestations: the same reason can cause different actions and the same action can be a result of different reasons. As a result, the individual as a living material system acts or is inactive, i.e. falls ill or remains healthy. Herewith, the disease manifests differently, i.e. originally, compensatory-adaptive capacities of the organisms act differently. That is why the analysis of each individual disease, even with the same nosological form, detects a different role of etiological factors, including the hereditary.

In the chapter "Adaptive and compensatory processes (adaptation)" [1] I. V. Davydovskiy states that the basis of the development of the morphological structures and their functional activities is made of the unity of organism and the environment. During the evolution, this unity has led to the development and consolidation of a huge number of adaptive responses and mechanisms associated with certain changes in the morphology. It is a wide range of adaptive abilities of a living body, which reflects the most important property of all living systems –permanent maintenance of the composition and quality under the varying conditions, dynamic order of the processes and restoration of the lost balance. This conservative principle of self-regulation works in the body together with the trend of reverse order - adapting "change during the epochs". Adaptation and changeability as biologically feasible factors take place continuously and invisibly to us. The biochemical basis of the constant evolutionary process includes the changes in the levels of energy potentials, plasticity of structures and functions, intensification or weakening of their activity. Adaptation to the environment is often acquired at the cost of considerable morphological and functional changes, "referring to the field of nosology". Everything that is used to be called physiological or pathological is an infinite number of adaptive acts expressed in compensation, subcompensation or even decompensation. Thus, it can be concluded that all the naturally occurring diseases (infectious and non-infectious), starting from the incubation period, by their biological nature, are adaptive. It is important that t*he quality of adaptation to the future*, but *not yet occurred events, is both the principle providing natural selection*.

Equation of adaptive and protective processes is not justified, although in the medical literature it is common. There are both protective and adaptive reactions. Klendusity are consciously focused on the release of a direct or indirect threat to life. The time period for a response is short and adaptation is not possible. Defensive reactions include physiological actions involving consciousness. Adaptive reactions are formed when the environmental factors become the factors of natural lifestyle of a living body. The higher the level of functional reserves of the body is, the more painless the adaptation to the changing living conditions is. Completeness of adaptation to the changing environmental factors is the state of compensation, completeness of health. In this case, physiological adaptive responses reflect *biological fitness of the organism to adapt*. Functional reserves of the body organs are huge, but it has no spare or unnecessary elements. However, the body, adapting, can create new structures providing the intensification of its activity, relieving the threat of depletion of the functional reserves. Adaptive responses take place as a knee-jerk reaction, being the field of automatic acts. The highest development of the adaptive processes was achieved by humans, as to the naturally developing adaptive reactions in the body they have added the *factor of conscious exercise*. Adaptive mechanisms confirm the *ecological* and philosophical principle of unity of the organism and the environment.

In the chapter "Etiology and ecology" [14] I. V. Davydovskiy defines the science of ecology as a field of biology which studies the adaptive processes in the organisms under different external environmental conditions. After all, the external environment is infinite and goes into the space. Failures in adaptation cause diseases as natural phenomena. Thus, environmental factors (factors of possible adaptation) unite with the etiological factors. Ecology as a science, which studies the principles of *natural selection*, is closely connected with the theory of evolution. Ecologic factors form species, varieties, wildlife classes, defining the energy, exchange and regulatory processes of the organisms. Adapting, the organisms use the basic environmental factors (physical, chemical and other regularities of the material world) and thus save their own energy resources. In this wise are produced reflex responses, which are the way of adequate adaptation to the negative environmental factors. The idea of "protection", replacing the idea of adaptation (i.e., acquisition and strengthening of the immune system) is inadmissible because in fact it is a denial of the development processes.

Adaptation, as a transition to a qualitatively new level of immune processes and existence does not guarantee painlessness of the process of adaptation. This is the most important factor of evolution and progress. In case of a disease, the entire picture and dynamics of the disease, which is a combination of morphological, physiological, chemical and immunological changes, "has a deep ecological sense". It is the quality and capacity of these abnormalities during the disease, which correspond to the *ecological fitness of the functional systems involved in the process of adaptation* and demonstrates the capabilities of the functional reserves of the body. In the chapter "Immunity as adaptation" [14] I. V. Davydovskiy considers the innate or natural immunity as a typical product of centuries-long adaptation to the relevant environmental factors. Immunity is the most important adaptation device of the organisms. Immunological abilities of a newborn organism cannot be defined. Adaptation of the wildlife to the effects of the environmental factors is not always ideal. In a complicated ecological situation, multiplicity of adaptation devices allows the organism of a given type to overcome strength tests of its physiological systems. It is *ecological fitness of the functional systems involved in the process of adaptation* and its adequacy to the environment with different factors of pathogenic significance, which allows the organism to maintain a stable, compensated state, remaining healthy. In the process of individual development, both prenatal and postnatal, the organism accumulates the acquired immunity. Innate immunity is both strengthened and weakened by a huge number of individual and social factors (nutrition, climate, occupation, etc.). Thus the functional reserves of the organism and the corresponding *ecological fitness of the functional systems involved in the process of adaptation* are strengthened or weakened.

Conclusion

In the middle of the twentieth century Academician I. V. Davydovskiy spoke about the urgent necessity to study biological regularities, which allows revealing true cause-and-effect relations between the traumatic factor and the quality of the traumatic process taking place in the body; between the introduction of the infectious matter and the occurred infection. This can be achieved when disclosing the nature of humans and their ecology in order to identify natural ways providing evolution of the humans as the biological species under the actively changing environment. Functional reserves of the human body organs are enormous, and the body, adapting, can create new structures to provide intensification of its activity. These are humans who can use the factor of conscious exercise for the development of the adaptive processes. That is why, the future of medicine, as a science providing genuine treatment of human diseases, is primarily made of wide prevention activities aimed at changing the environment and lifestyle of humans, improving the environmental of ecological fitness of the functional systems involved in the process of adaptation, strengthening ecological adequacy of body structures and functions, and expanding the range of its adaptive abilities. To do this, it is important that the subject of medical research was a healthy person and search not only for individual, but also for typological and collective opportunities to "adaptively respond" to any effect. These approaches expand potential opportunities of preserving and strengthening human health. So, the main conclusions are:

1. Pathology is a vast field of biology, which studies the manifestations of life disorders that occur in case of insufficiency of organism adaptive reserves.
2. Pathological mechanisms represent the same physiology manifested in adverse life conditions.
3. No matter what the external factors are, the biological readiness of the organism to adapt determines the principal possibility of development of either physiological or pathological processes.

4. The state of the adaptive mechanisms of a person makes it a kind of modus in rebus, the transformation of pathological into physiological and back.
5. The ability to adapt makes the basis of health.
6. Improvement of biological fitness of the organism to adapt is the improvement of its functional reserves.
7. The highest development of adaptive processes were achieved in humans, as to the naturally developing adaptive mechanisms in the body, they added the factor of conscious exercise.
8. Ecology is the field of biology, which studies the adaptive processes in the organisms under different external environmental conditions, the principles providing natural selection.
9. The quality of adaptation to the future, but not yet occurred events, is at the same time the principle providing natural selection.
10. The quality and capacity of morphological, physiological, chemical and immunological changes during the disease corresponds to the environmental fitness of the functional systems of the body involved in the process of adaptation.
11. The future of medicine is made not only of the treatment of individual patients but also of the disease prevention and achievement of no disease incidence.
12. It is important to study the nature of the diseases and health state in terms of the adaptive mechanisms that guarantee self-preservation of humans as biological species in the changing environment.

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