Federal State Budget-funded Educational Institution of Higher Education Professor V. F.  Voino-Yasenetsky Krasnoyarsk State Medical University of the Russian Federation Ministry of Health

A. T. Pshonik Department of Physiology

**GUIDELINES FOR STUDENTS**

**for individual study in**

**Normal Physiology.**

**Specialty 31.05.01 – General medicine**

**TO THE PRACTICAL LESSON**

**from 11.05.2022 to 17.05.2022**

Topic

**Physiology of stress. Mechanisms of urgent and long-term adaptation. Physiological mechanisms of mental and labor activity (seminar discussion in combination with student reports in an interactive form).**

**Questions to discuss in class:**

1. Adaptation of the body to physical, biological and social factors. Types of adaptation.

2. Significance of nervous, endocrine and genetic factors.

3. Stress. The mechanism of development of the general adaptation syndrome.

4. Biological rhythms and their significance in human activity and its adaptation to extreme conditions.

5. Classification of biorhythms, their stability and variability, desynchronosis.

6. Features of human adaptation to climatic and geographical factors of habitat.

7. Physiological basis of labor activity. Features of physical and mental labor.

8. Features of work in the conditions of modern production, fatigue and active rest.

9. Genotypic and phenotypic adaptation, phases of adaptation

10. Stress, the mechanism of the general adaptation syndrome.

11. Adaptation of the organism to the action of hypoxia, cold, lack of information

12. Biorhythms, classification

13. The value of biorhythms. Desynchronosis.

ANNOTATION

The word "adaptation" comes from the Latin word "adaptatio" which means adaptation. The whole life of a person, both healthy and sick, is accompanied by adaptation. Adaptation takes place to the change of day and night, seasons, changes in atmospheric pressure, physical activity, long flights, new conditions when changing place of residence.

In 1975, at a symposium in Moscow, the following formulation was adopted: physiological adaptation is the process of achieving a stable level of activity of the control mechanisms of functional systems, organs and tissues, which ensures the possibility of long-term active life of the animal and human organism in the changed conditions of existence and the ability to reproduce healthy offspring .

There is a genotypic adaptation as a result of when, on the basis of the heredity of mutations and natural selection, the formation of modern animal and plant species occurs. Genotypic adaptation has become the basis of evolution, because its achievements are fixed genetically and are inherited.

The complex of specific hereditary traits - the genotype - becomes the point of the next stage of adaptation, acquired in the process of individual life. This individual or phenotypic adaptation is formed in the process of interaction of an individual with the environment and is provided by deep structural changes in the organism.

Phenotypic adaptation can be defined as a process that develops in the course of individual life, as a result of which the organism acquires previously absent resistance to a certain environmental factor and thus gains the opportunity to live in conditions that were previously incompatible with life and solve problems that were previously insoluble.

At the first encounter with a new environmental factor, the body does not have a ready-made, fully formed mechanism that provides a modern adaptation. There are only genetically determined prerequisites for the formation of such a mechanism. If the factor did not work, the mechanism remains unformed. In other words, the genetic program of an organism does not provide for a pre-formed adaptation, but the possibility of its implementation under the influence of the environment. This ensures the implementation of only those adaptive reactions that are vital. In accordance with this, it should be considered beneficial for the conservation of the species that the results of phenotypic adaptation are not inherited.

In a rapidly changing environment, the next generation of each species runs the risk of meeting with completely new conditions, which will require not the specialized reactions of ancestors, but the potential, remaining, for the time being, untapped ability to adapt to a wide range of factors.

Urgent adaptation is an immediate response of the body to the action of an external factor, carried out by avoiding the factor (avoidance) or by mobilizing functions that allow one to exist despite the action of the factor.

Long-term adaptation - a gradually developing factor response ensures the implementation of reactions that were previously impossible and existence in conditions that were previously incompatible with life.

The development of adaptation occurs through a series of phases.

1. The initial phase of adaptation - develops at the very beginning of the action of both physiological and pathogenic factors. First of all, under the action of any factor, an orienting reflex occurs, which is accompanied by the inhibition of many types of activity that have manifested up to this point. After inhibition, an excitation reaction is observed. Excitation of the central nervous system is accompanied by increased function of the endocrine system, especially the adrenal medulla. At the same time, the functions of blood circulation, respiration, and catabolic reactions are enhanced. However, all processes in this phase proceed uncoordinated, insufficiently synchronized, uneconomical, and are characterized by the urgency of reactions. The stronger the factors acting on the body, the more pronounced this phase of adaptation. Characteristic of the initial phase is the emotional component, and the strength of the emotional component depends on the "launch" of vegetative mechanisms that are ahead of the somatic ones.

2. Phase - transitional, from initial to sustainable adaptation. It is characterized by a decrease in the excitability of the central nervous system, a decrease in the intensity of hormonal changes, and the shutdown of a number of organs and systems that were originally included in the reaction. During this phase, the adaptive mechanisms of the body, as it were, gradually switch to a deeper, tissue level. This phase and the processes accompanying it are relatively little studied.

3. The phase of sustainable adaptation. It is actually an adaptation - an adaptation and is characterized by a new level of activity of tissue, membrane, cellular elements, organs and systems of the body, rebuilt under the cover of auxiliary systems. These shifts provide a new level of homeostasis, an adequate body and other adverse factors - the so-called cross-adaptation develops. Switching the body's reactivity to a new level of functioning is not given to the body "for nothing", but proceeds under the tension of the control and other systems. This tension is called the price of adaptation. Any activity of an adapted organism costs it much more than under normal conditions. For example, physical activity in the mountains requires 25% more energy.

Since the phase of stable adaptation is associated with a constant tension of physiological mechanisms, functional reserves in many cases can be depleted, the most depleted link is hormonal mechanisms.

Due to the depletion of physiological reserves and disruption of the interaction of neurohormonal and metabolic mechanisms of adaptation, a condition occurs, which is called maladaptation. The phase of disadaptation is characterized by the same shifts that are observed in the phase of initial adaptation - auxiliary systems again come into a state of increased activity - breathing and blood circulation, energy in the body is wasted uneconomically. Most often, disadaptation occurs in cases where functional activity in new conditions is excessive or the effect of adaptogenic factors is enhanced, and they are close to extreme in strength.

In the event of the termination of the factor that caused the process of adaptation, the body gradually begins to lose the acquired adaptations. With repeated exposure to a subextreme factor, the body's ability to adapt can be increased and adaptive shifts can be more perfect. Thus, we can say that adaptive mechanisms have the ability to train, and therefore the intermittent action of adaptogenic factors is more favorable and determines the most stable adaptation.

**Literature**

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4. Silbernagl, S. Color Atlas of Phisiology / S. Silbernagl, A. Despopoulos. - 7th ed. - Stuttgart : Thieme, 2015. - 458 p.

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