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Investigations of higher nervous activity, personal psycho-physiological functions in extreme conditions for pilots' professional selection

In present report some methods and results of higher nervous activity and psycho-physiological human functions in extreme high mountain conditions will be described. These results were put in base of development of the theory and practice of professional selection for professionals like pilots, rescuers, alpinists, operators, persons from special contingents and others for the work in extreme conditions.

The formulation of the problem of professional selection reflects the social needs of contemporary society in increasing of work intensifying, ensuring the reliability of organism's functioning, life safety, injury prevention, saving finances, material and technical means, preserving health as well as extending labor longevity. The professional suitability of candidates to work in this or that industry is estimated basing on medical indicators, educational level, physical fitness, and etc. The type of higher nervous activity (HNA), its mode of functioning, its characteristics are crucially important for this too.

The ***purposes of*** presented report are to demonstrate some results of investigations of changes in human higher nervous activity (HNA) that occur at high mountain altitudes, the influence of hypoxia on HNA. In continuation to show the results of investigation of human brain psychophysiological functions; their changes in extreme highlands conditions, as well as to present some methods of professional selection that were developed at Ukrainian research center - EMBS. The brief information will be given too about the applying of these results for professional selection of the people for the work as operators in extreme conditions.

Traditions of the investigations. Improving the system of training, distribution and placement of personnel in various branches of the economy is an important task today. One of the main directions of this problem solution is the further improvement and development of new methods and criteria for evaluating of the successes of person's professional activity, or, in other words, the further development of a system of professional selection. Especially those ones who work in extreme conditions linked with the contemporary war in Ukraine and necessity of different tasks fulfillment in this reality. Ukrainian scientists have the experience and knowledge for such tasks solution. In previous decades the great volume of the works for studying of HNA functioning in extreme conditions and these results applying for some groups of persons, their professional selection Ukrainian scientists had done in high mountain regions of the Caucasus, at the Elbrus Medical and Biological Station (EMBS) of the National Academy of Sciences of Ukraine (situated at Elbrus slopes in Kabardino-Balkar Republic of RF). Works on the study of the influences of high-altitude factors on organisms were initiated by academician

M. M. Syrotynin in 1929. Further they were continued by Professor, Dr. Med. Sci Biloshitsky P.V., his student and collaborator for many years, other colleagues from the laboratory of space physiology at EMBS [1-5]. Researchers Yu.L. Maidykov, M.V. Makarenko, A.O. Navatikian, V.A. Buzunov, A.V. Karpenko, V.V. Kalnysh [6] devoted long years of investigations to these problems studying. Their findings convince that, from a practical point of view, the problem of predicting the success in professional activity depends on two main aspects:

- determination of the requirements offered to a person by this or that activity;

- estimation of the state of his(her) respective abilities that limit this activity.

Studies by Ukrainian scientists of the higher nervous activity in extreme conditions. Ukrainian pathophysiologists paid their attention to the studies of HNA during long years along with professionals in the whole world [1-6]. Special attention was attracted to the phenomena of HNA functioning in extreme conditions, when human organism is "between life and death". Such reality one can find in high mountains, in environment "conditionally suitable for life". In these conditions all living forces of organism are concentrated usually on the saving of human's life, and functions of body's organs and systems demonstrate relative reactions. Oxygen deficiency (hypoxia) plays an important role in such stress states development. A person's stay in highlands, in mountainous conditions, consequently is the prerequisite for the development of changed states of HNA, the organism in whole [6-7]. Such states were studied by our scientists using modern technical equipment, devices that were elaborated by engineers especially for these purposes [2, 3, 7- 10] and ones in continuation of classic traditions [8, 11]. Novel original experimental and laboratory techniques were developed for these purposes as well as a set of computer programs, mathematical models [3, 4, 7, 8, 12, 13]. Such studies contribute to the understanding of human brain functioning in extreme conditions, in stressful situations, in cases of hypothermia, oxygen deficiency, overloads. They are extremely important for training of the work of pilots, rescuers, climbers, operators, representatives of other special forces and groups. Such experience is really valuable too for the Ukraine today, in war reality.

Psychophysiological selection as integral part of professional selection. Psychophysiological selection as integral part of professional selection, is directed on identifying of persons who, by professional abilities and individual psychophysiological qualities, meet the requirements of specific specialties. Such people are the most suitable for training in the prescribed period and for the next successful professional activity [1-3, 7, 14]. Many professions are combined not only with the performance of a set of specific work operations, but also with the mode of work and rest. For example, there are can be shift works with periodic work at night, duties work at the control panel, etc.). Other professions are linked with specific environmental features (work in conditions of noise, vibration, acceleration, hypoxia, limit time, etc.), with extreme factors (nervous-emotional overloads). Such professions were chosen by pilots, cosmonauts, drivers, machinists-operators of block equipment, persons whose labor activity takes place in the conditions of service area expanding, increasing the power of units, engines, etc. Basing on the results of investigations at EMBS, it can be stated that the use in operator positions

of persons who do not have appropriate level of development of professionally important psychophysiological qualities leads not only to the appearance of errors in their work (sometimes fatal ones), occurrence of emergency situations; this also cause adversely effects on their health. Such workers demonstrate more often the cases of development of diseases of central nervous systems (CNS) and cardiovascular systems.

The success of professional psychodiagnostics largely depends on the choice of methodical principles and techniques adequate to the goals and objectives of research. This work presents some basic research methods and scales for the estimation of the state of professionally significant psychophysiological functions (neurodynamic and neuropsychological levels, as well as personal specificity) and their relationship with the success of the work of testers, rescuers, and operators of various modern high-responsibility complexes. More than 300 people were examined and studied at EMBS - testers, climbers, candidates to astronauts, drivers, and power unit operators who mainly control technological process, remotely identify and eliminate violations in the equipment's operating mode. The item of this report continues the topic of human HNA research at EMBS (namely, publications [1-4, 7, 14].

Conclusions. The basis of the reliability and success of the professional activity of a person-operator is a whole complex of physiological and psychophysiological systems that organize a functional system aimed at obtaining the final result. The success of the operators is largely determined by the individual and typological features of the HNA of the neurodynamic apparatus and vegetative sphere, the function of attention, memory, and perception. operational thinking, personal characteristics of a person. All these functions are directly related to the formation and use of professional skills of the personnel of operators of modern technical means. It has been established that adaptation to the conditions of the mountain climate (climate therapy belongs to informational methods of treatment, prevention, rehabilitation. increasing work capacity, improving sports results and reliability of the body's functioning in extreme conditions) increases the mental and physical capacity of operators, increases the efficiency and reliability of their work after fatigue and various stressful conditions. Theoretically, up to the some extends such works today can be continued in the highlands of Ukrainian Carpathians.

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