To the question about the cognitive processes control in the system «operator-computer complex».

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***Abstract* – To study the peculiar features of cognitive state and adaptation mechanism in young engineer-programmers (30 years and younger) and define the degree of production environment influence on functioning efficiency of the system "operator – computer complex".**
Materials and methods. 43 engineer-programmers are inspected, men in age from 21до 28 years before the beginning and after ending of working day. 20 healthy persons comparable on age with inspected basic group entered in a control group, not systematic working with a computer technique. Psychoemotional status, reaction on the physical loading with the calculation of maximal consumption of oxygen, state of the system of free radical oxidization of blood plasma were explored, cyclic nucleotids were determind by thinlayer chromotografy method, the molecular-genetic analysis of genotypes of angiotensin converting enzyme is conducted, the features of the vegetative providing of adaptation organism reactions are studied.
Results. Engineer-programmers have the hidden system disbalance of free radical oxidization with insolvency of antyoxidant defence mechanisms, which developed on a background violation of the power providing of organism adaptation reactions. In persons from the genotypic mangyotenzyn converting enzyme DD the most substantial energy deficit is exposed.
Conclusion. The selection of professional staff is scientifically grounded for long work with a computer technique and the necessity of development highly mobile reverse connection in the system is proved «operator is computer complex».
Index terms – pedagogics of high technical school, operator of computer complex, cognitive processes, adaptation

General functioning reliability of the ergastic type biotechnical systems is determined by efficiency of functioning of its biological bond - operator. Professional activity of engineer-programmer is not only connected with influence of a number of physical factors (ionizing and optical radiation, electromagnetic and electrostatic field, high-frequency noise) but also is accompanied by tension and overstrain of higher nervous activity and systems of the vegetative providing.

The study of cognitive state features and adaptation mechanisms was a research purpose in engineer-programmers and to define influence of production environment factors on functioning efficiency of the system «operator computer complex».

In 43 engineer-programmers (middle ages 24,8 ± 3,1 years) the researches are conducted before the beginning and after ending of working day. For a control the indexes of the functional state clinically healthy people of comparable age, not working with a computer technique, are used. At the same time the determination was carried out in research:

- psychoemotional status and psychoenergetic potential.
- the states of free radical oxidization system (FOS).
- reaction on the physical loading with the calculation of maximal consumption oxygen (MCO).
- vegetative providing of adaptation reactions of organism.
- indexes of energy exchange.

Psychoemotional status was estimated by the «POMS [3] test», determining the factors of anxiety (T), depression-depression (D) , anger-aggressiveness (A), force-activity (V) , fatigue-tired (F) and embarrassment-confusion (C).

Psychoenergetic potential was determined by the coefficient of psychoenergetic potential (PEP) (1).

The state of the FOS system was estimated in plasma of inspected blood by of byochemyfluorescency method (BCHF) on an integral index characterizing correlation of free-radical oxidizing processes and activity of the antioxidizing systems of organism

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$$\text{PEP} = \frac{V}{\frac{T + D + A + F + C}{5}} \quad (1)$$

where V, T, D, And, F, With are values of factors of the «POMS test».

(AO). The research was made before the beginning of working day and after ending. The analysis was made on chemyfluonometre ХЛМ1Ц-01, using a 0,2 ml whole blood taken from the finger of inspected, in potassium phosphate buffer solution for BCHF rN 7,4. Determined spontaneous (SCHF) and induced by the ferrous sulfate BCHF. Processing of sulfuric parameters in plasma of blood gave the level diagnostic information of spontaneous superweak luminescence, and at the FOS induction - about maintenance of hydroperoxidess and speed of lipids oxidization of peroxide (LOP), correlation of prooksydantov and endogenous AO and resistance of lipids in blood plasma to the process LOP.

For the functional testing the standard loading on bicycle ergometer (test PWC170), being unspecific for the persons of the explored and control groups, was used, which played the role of starting mechanism of inclusion of metabolism. On research results maximal consumption of oxygen was calculated (MCO).

For determination of the vital functions vegetative providing before the beginning and after ending of working day was made estimation of variability of cardiac rhythm (VRS) according to Baevsky [2]. The 5-minute segments of cardiac rhythm, registered by the kholterov system of monitoring, were analysed „DiaCard". Researches were made at peace and at implementation of active ortostatic test.

Estimation of the power providing of organism was conducted on the basis of determination of cyclic nucleotids in the red corpuscles of blood by the method of thin-layer chromatografy on plates „Sylufol". Concentration adenosinthreephosphate (ATP) was studied, adenosindiphosphate (ADP), adenosinmonophosphate (AMP), sum of nukleotids and the ATP/AMP correlation.

A test on determination of genotypes was used angyangiotensin converting enzyme was used as a method of molecular-genetic analys (MGA), connection of which with energy balance in an organism is shown in a number of researchers [1, 4]. For determination of equilocal genes (allele) and the MGA gene genotypes of the method of getting of genomic deoxyribonucleic acid (DNA) from the cells of mucous membrane of mouth space was used. DNA was selected by means of alkaline extraction, polymorphic area of gene of amplificated by the polymerase chain reaction. The products of reaction were determined by the method of electrophoresis in a 8% polyacrylamide gel [5].

Research results are processed with the use of multivariate analysis through a statistical software package SPSS 9.0 for Windows.

Before the beginning of working day the engineer-programmers had the reduce of the SCHF level, that points to the presence of homeostatic reactions in an organism, regulating processes LOP (table 1)

In the conditions of the system stimulation of FOS by ferrous sulfatethe considerable increase of concentration in the blood of hydroperoxides was seen, speed of LOP processes , at time lengthening of latent period of reaction. In reaction to physiological stimulation the system of the FOS engineer-programmers answered by the inadequate increase of hydroperoxides formation in plasma of blood and intensification of LOP processes as compared to the values certain in a control group. At the same time, at engineer-programmers resistance of plasma to LOP is reduced, that was characterized by surplus accumulation of products of free-radical reactions in reply to addition in plasma of standard of the FOS inductor dose, as compared to the control.

Findings are undoubtedly specified that there is hidden disbalance of the FOS system in the engineer-programmers, which comes to light in the conditions of physiological stimulation of the inadequate activating LOP. Permanent tension of antioxidant bonds of the FOS system is reflected in the reduce of the SCHF level, lengthening of latent period of reaction and the sum of light BCHF reduction and explains their exhaustion and insolvency, as adjusting of functioning of the FOS system goes outside a physiological corridor. The orientation of functional changes in the FOS system, that is going on at the end of working day in engineer-programmers, shows the reduce of AO activity (substantial shortening of latent period of reaction, approaching an index certain in the control, P>0,05), as compared to beginning of working day.

Insolvency of defence AO mechanisms developed on a background power processes violation, which, presumably, lie in basis of processes of organism adaptation to the physical, cognitive and psychoemotional loadings. The results of the of power exchange research are reliabled that there is on the reliable reduce of main energy transmitter - ATP, reduction of the ATP/AMP correlation and increase of the AMP level in engineer-programmers, all these indicate the power unhappiness of organism, as compared to a control group (table 2)

The research of vegetative adaptation process in engineer-programmers to the cognitive and psychoemotional loadings exposed the overstrain of adaptation mechanisms (the AMo increase, the DKH reduce and high YN) at 34 (79,1%) persons, and at 16 (37,2%) is derangement of adaptation mechanisms, on what the increase of the Mo index, DKH, the DMo reduce and sharp reduce YN at orthostatic to the test (table.3) indicate.

The obtained results of molecular-genetic research ground give us the reason to confirm that the substrate level of the bioenergy providing of organism is proved by genetic determination. Comparing the results of energy exchange with different genotypes MGA - II, ID, DD, it is possible to say, that the most inspected with the DD genotype have the signs of energy deficit (reduce of the PEP values, less concentration ATP, overstrain of adaptation reactions, activating of the FOS processes on a background the defence of components of AO of deficit). The multiparametric correlation analysis of large complex of findings allowed to reveal statistically meaningful correlations between the psychophysiologics factors of the «POMS test», the speed LOP in plasma and duration of latent period of reaction, the ATP concentration, AMP with MCO. In scientific literature MCO is considered as the marker of psychophysiologic tolerance and physical endurance, having genetic determination [6]. On a correlation count the interaction among the explored parameters are represented.

This research reverals the dependence between genotypical description of personality in engineer-programmer on MGA and efficiency of adaptation mechanism functining having in basis adequate energy support at substrate level peculiars. Features of adaptation in engineer-programmers can be explained taking into account the specific of the MGA genotypes, which determine functional resources both cardiorespiratory and nervous systems of organism. So, scientifically proved prospects of professional staff for long-time work with the computer are opened. More over, exposed deficit of antioxidant defence and energy substances, leads to derangement of indemnification forming of free radical pathological process

The findings also reveal the actuality of the highly mobile reverse bonds development in the system «operator computer complex» in those case, when the urgent change of the activity mode or correction of the state is required. The overcoming of the contradiction between the intensive psychoemotional loading and high capacity allows to save inspected resistance to the influence of complex of factors of production of production environment complex factors.

Table 1. Functional state of free radical oxidization system of lypids of blood plasma.

Index	Explored group		Control group
	Before the beginning of work	On at the end completion of work	
SCHF, ymp./мин	426 ± 24*^	542±28	635 ± 17
Table of contents of hydroperoxides in plasma, ymp./c	118,6±6,1*^	106,4± 2,5*	79,4 ± 5,3
Speed is LOP, ymp./c	37,5± 1,9^	64,7± 5,8*	29,4 ± 2,2
Latent period of reaction,s	143,6±11,3^	84,6 ± 9,2	86,2 ± 7,5
Svetosumma BCHF plasma, ymp./c	13594±785^	18218 ± 734*	22837± 529
Rezystentnost' of plasma to LOP, ymp./мин	9247±424*^	12165 ± 816*	6479± 358

Note: «*» is authenticity of distinctions as compared to a control group

P< 0,01;

«^» is authenticity of distinctions between indexes certain

before the beginning and on ending of the work P< 0,05.

Table 2. Indexes of power exchange.

Index	Explored group	Control group	P
Adenozyntryfosfat (ATP), мкмоль/л	497,63± 17,47	692,44± 22,8	< 0,05
Adenozyndyfosfat (ADP), мкмоль/л	161,37 ± 3,24	205,36 ± 6,1	< 0,05
Adenozynmonofosfat (AMP), mkmol'l	65.42 ± 1,06	27,59 ± 1,6	< 0,01
АТФ/АМФ	7,6 ± 0,26	25,1 ± 0,32	< 0,001

Table 3. Indexes of cardiointervalografy at the inspected persons.

Index	Mo, with	AMo, %	DKH, with	YN, usl. ed.
Lying	0,88 ± 0,06	62,26± 2,03	0,127±0,005	335 ± 28,4
Standing	0,69 ± 0,03	60.19 ± 2,79	0,12 ± 0,003	418 ± 39,8

Note: Mo is fashion; AMo is amplitude of fashion; DKH is variation scope; YN is index of tension.

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