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**DEPARTMENT OF GENERAL HYGIENE
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WORK PHYSIOLOGY

**Methodical grant for independent work
on the general hygiene for medical students**

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Origin of physiology of work is connected with increase in production, emergence of new types of work and carried to the second half of the 19th century. Such scientists, as well as. L. Pavlov, I.M. Sechenov, V.M. Bekhterev, have made a huge contribution to studying of human physiology in the conditions of work.
Work, be it physical, intellectual, creative, plays an important role in human life. He not only is an intermediary of receiving appliances, but also fundamental criterion in determination of the social status of the person. Besides on character and intensity of work substantially depend a physical and mental condition of the person.
Work of the person proceeds in the conditions of a certain production environment which at non-compliance with hygienic requirements can exert adverse impact on working capacity and health of the person.
Occupational health – the preventive medicine studying conditions and the nature of work, their influence on health, a functional condition of the person and developing the scientific bases and practical measures directed to prevention of harmful and dangerous action of factors of the production environment and labor process on working. The character and the organization of work has significant effect on change of a functional condition of a human body. Work shares conditionally on physical and brainwork.
Distinguish three types of muscular work:
• dynamic positive at which movement of freight in the direction opposite to gravity (lifting of loads) and movement is made across;
• dynamic negative when the movement is made in the direction of the gravity (lowering of freight);
• static at which movement of freight isn't made and the muscular effort is directed to his maintenance or providing the position of a body of the person connected with work.

Classification of work by severity and tension
Weight of work – the characteristic of labor process reflecting primary load of the musculoskeletal device and the functional systems of an organism (cardiovascular, respiratory, etc.) providing his activity. It is characterized by physical dynamic activity, mass of the lifted and moved freight, movements in space, a working pose.
Tension of work – the characteristic of labor process reflecting load mainly of the central nervous system, sense organs, the emotional sphere of work. Treat the factors characterizing tension of work: intellectual, touch, emotional loadings, monotony of loadings, operating mode.

Hygienic classification of working conditions:
1 class – optimum working conditions – such conditions under which not only health working remains and are created prerequisites for support of high level of working capacity;

2 class – admissible working conditions – are characterized by such levels of factors of the production environment and labor process which don't exceed the established hygienic standards for jobs, and possible changes of a functional condition of an organism are restored during the regulated rest or prior to the following shift and don't exert adverse impact on health working and their posterity in the next and remote periods;
3 class – harmful working conditions – are characterized by existence of harmful production factors which exceed hygienic standards and are capable to cause adverse influence on an organism working and his posterity;

4 class – dangerous (extreme) – working conditions which are characterized by such levels of factors of the production environment which influence during working hours (or her parts) create high risk of emergence of severe forms of sharp professional defeats, poisonings, mutilations, threat of life.

Factors of the production environment, the organization of work and production which can serve directly or indirectly as a cause of infringement of working capacity or health working are called production vrednost.

The production factors influencing working can include:

- chemical, physical and biological harmful factors of the production environment;
- features of productions and equipment;
- character and organization of work;
- organization of jobs;
- state and hygienic efficiency of sanitary and hygienic devices and individual protection equipment;
- household providing working at a factory;
- psychological climate in labor collective.

All physical works divide into three categories on the basis of the general energy expenditure of an organism.

Easy physical works (I category): Ia (energy expenditure up to 139 W) – the works performed sitting and followed by insignificant physical tension (a number of professions at the enterprises exact priboro-and mechanical engineering, hour, sewing productions, in the management sphere, etc.); Ib (140-174 W) – the works

performed sitting, standing or connected with walking and followed by some physical tension (a number of professions of the printing industry, on telecommunications agencies, controllers, masters in different types of production).

Works of average weight (II category): IIA (175-232 W) – the works connected with continuous walking, movement small (up to 1 kg) objects in a standing position or sitting and demanding a certain physical tension (a number of professions in machine-assembling shops of machine-building enterprises, in spinning and weaver's production); IIB (233-290 W) – the works connected with walking, weight movement (up to 10 kg) and followed by moderate physical tension (a number of professions in the mechanized foundry, rolling, forge, thermal, welding shops of the machine-building and metallurgical enterprises).

Hard physical work (the III category) – energy expenditure more than 290 W. The works connected with continuous movement and carrying of weights (more than 10 kg) demanding great physical efforts (a number of professions in forge shops with manual forging, foundry shops with manual stuffing and filling of a molding of the machine-building, metallurgical enterprises).

Indicators of energy expenditure when performing these or those works provide only relative assessment of weight of work as the power consumption is influenced also by other important points (fitness, the organization of work, a work-rest schedule, a condition of the air environment).

Physiological changes in an organism during the work

In operating time there are essential morphological, physical and chemical changes of blood. The quantity of erythrocytes, hemoglobin and leukocytes due to receipt from depot (spleen), and strengthening of an eritropoez and a leykopoez increases. Increase in osmotic pressure and viscosity of blood is connected with increase in quantity of uniform elements and reduction in plasma of blood of water which of blood diffundirut in the working muscles. Concentration of sugar in blood from 80-90 mg of % increases up to 130-150 mg of %, and at hard work decreases to 60 mg of % and below. Considerably the content of sugar increases in blood during

the work connected with great emotional pressure. When working various weight the content in blood of lactic acid changes: from 1,1-2,8 mmol/l is normal, at very hard work – 5,6-6,7 mmol/l. Easy or medium-weight work doesn't cause accumulation of lactic acid as she is in time will be oxidized and to resintezirovatsya. At rest of fabric take away 20-30% of oxygen, and during the work to 70%. The relation of an arterial and venous difference of oxygen to oxygen capacity is called utilization coefficient oxygen. During the work as a result of a hyperventilation the content of carbonic acid in blood decreases.

Changes in cardiovascular system: the systolic volume of heart increases from 60-80 ml, during the muscular work twice and more. Between intensity of work and pulse rate there is a certain dependence: during the easy works the pulse rate exceeds 100-120 beats per minute, at hard work pulse can reach 140-160 beats per minute and more. Blood pressure changes: the maximum pressure increases, and minimum doesn't change. The minute volume of heart, pulse rate and blood pressure are usually normalized after other functions.

In the course of work it is noted the expressed breath function shifts. The increased need for oxygen and removal from an organism of carbon dioxide is provided with increase and deepening of breath. The number of dykhaniye from 12-24 in a minute increases to 30-35 and more. Pulmonary ventilation from 4-10 l/min increases up to 50-100 l/min and more. Consumption of oxygen from 150-300 ml/min. when performing hard work increases at 10-15 times.

The leading physiological criterion of a condition of an organism is oxygen consumption. Amount of the oxygen consumed by the person on an empty stomach in a condition of muscular rest, lying, is an indicator of the exchange necessary for maintenance of the vital functions at rest, i.e. the main exchange.

The main exchange is influenced by a sex, age, growth, weight and the surface of a body, structure of food, climatic conditions, etc. The need of an organism for oxygen of subjects is more, than work is heavier. The amount of oxygen necessary for full oxidation of products of disintegration in a minute, is called "oxygen

inquiry", and the maximum quantity of oxygen which the organism can receive in a minute is designated as "an oxygen ceiling".

"The oxygen ceiling" when performing physical activity at unexercised people makes about 3 l/min, and at trained can to reach 4-5 l/min. At first work is followed by incomplete satisfaction of "oxygen inquiry" owing to what "the oxygen debt" collects. This results from the fact that power processes in a muscle at her reduction happen instantly, and delivery of oxygen increases not at once. When delivery of oxygen corresponds to "oxygen inquiry", there occurs steady consumption of oxygen.

The "Oxygen debt" formed at the beginning of work is completely repaid after termination of work, during restoration. At hard work oxygen consumption all the time grows up to achievement of "an oxygen ceiling". If "the oxygen inquiry" during the work exceeds "an oxygen ceiling", then there comes the so-called false steady state; at the same time consumption of oxygen reflects only "an oxygen ceiling", but not the true need for oxygen. The recovery period at the same time is considerably extended. Therefore, on consumption of oxygen and duration of the recovery period it is possible to judge weight of work.

Exhaustion and overfatigue

Understand the special physiological condition of an organism arising after the done work and which is expressed in temporary decrease in working capacity as exhaustion.

Working capacity – the size of functionality of a human body which is characterized by quantity and quality of the work performed in a definite time. During work the operability of an organism changes in time. Distinguish three main phases of the conditions of the person replacing each other in the course of work:

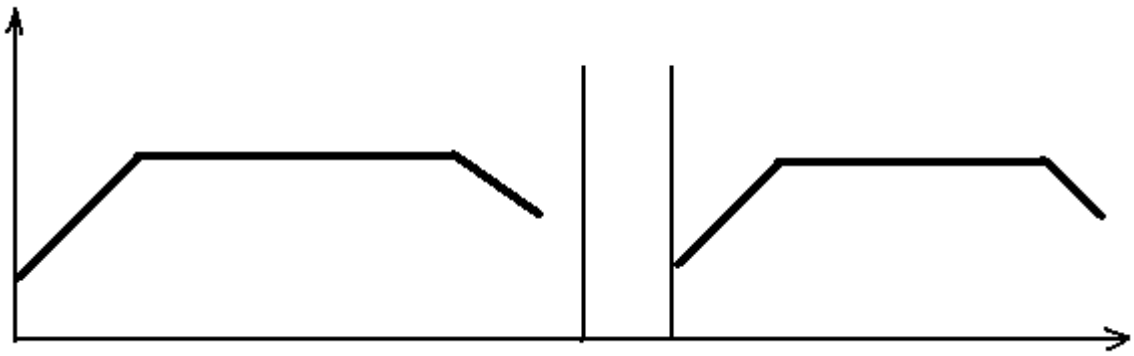
- a vrabatyvaniye phase, or the increasing working capacity; during this period working capacity level gradually increases in comparison with initial; depending

on the nature of work and specific features of the person this period lasts of several minutes till 1,5 o'clock, and at intellectual creative activity – till 2-2,5 o'clock;

- phase of high stability of working capacity; the combination of high labor rates to relative stability is characteristic of her or even some decrease in tension of physiological functions; duration of this phase can be 2-2,5 hours and more depending on weight and tension of work;

- the phase of decrease in working capacity which is characterized by reduction of functionality of the main working human organs and followed by feeling of fatigue.

One of objective signs is a decline in production of work, subjectively it is expressed in feeling of fatigue, i.e. in unwillingness or impossibility of further further work. The exhaustion can arise at any kind of activity.



The exhaustion is connected with changes of a physiological condition of all organism, and as a result of long or hard work, and the separate value has violation, arising in the central nervous system.

At long impact on an organism of harmful factors of the production environment the overfatigue called sometimes by chronic exhaustion when night rest completely doesn't restore the working capacity which has decreased in a day can develop.

The constant discrepancy of duration and weight of work and time of rest forms a basis for emergence of overfatigue. Besides, the unsatisfactory situation of work, adverse living conditions, bad food can contribute to the development of overfatigue.

Overfatigue symptoms – various violations from the psychological sphere, for example easing of attention and memory. Along with it at the overstrained people headaches, frustration of a dream often are observed (insomnia), deterioration in appetite and the increased irritability.

Besides, chronic overfatigue usually causes weakening of an organism, decrease in its resilience to external influences that is expressed in increase in incidence and traumatism. Quite often this state contributes to development of a neurasthenia and hysteria.

Important measure of prevention is justification and introduction in production activity of certain principles which include: gradual entry into work, maintenance of an optimum rhythm of work, respect for a certain sequence of the carried-out operations, the correct alternation of work and rest, creation of rational sanitary conditions at the enterprises.

In increase in working capacity positive emotions have considerable value that is provided with the correct organization of production, an optimum microclimate, normal hygienic conditions in workplaces (workplace ergonomics), the good organization of living conditions, food and rest. The important place in formation of positive emotions belongs to means of an industrial (technical) design – to creation of color climate, production music, the organization of the benevolent relations in collective.