

BELARUSIAN STATE UNIVERSITY

Establishment of Education
«International Sakharov Environmental Institute»



ACTUAL ENVIRONMENTAL PROBLEMS

Proceeding of the VII International
Scientific Conference of young scientists,
graduates, master and PhD students



November 23–24, 2017
Minsk, Republic of Belarus



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INFLUENCE OF BLOOD IRRADIATION BY A HELIUM-NEON LASER ON ITS CELLULAR AND BIOCHEMICAL INDICATORS

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Blood parameters are one of the most striking reflections of the general state of the body. Influencing them in patients with a violation of their normal ratio can achieve a significant therapeutic effect. In general, this is done by chemical preparations that can have side effects or individual intolerance in the patient. Therefore, as an alternative, you can choose another method of action - low-intensity laser therapy. Currently, the most popular for this purpose, a helium neon laser through low cost and optimal performance. Its main targets are proteins involved in energy metabolism of cells and iron metabolism. This makes it possible to use it to normalize the operation of these systems, which in turn will affect the general condition of the human and contribute to his recovery.

Keywords: cellular blood indices, biochemical blood indices, low-intensity laser therapy, helium neon laser.

Blood parameters are one of the most striking reflections of the general state of the body. This is determined by the fact that blood is a liquid tissue that provides transport of nutrients, oxygen and metabolic products between all cells of the body, which is its main function. In addition to this function, it performs other, equally important, such as immunological, regenerative, signaling and many others. In accordance with its functions, the blood has several different indicators, which are conventionally divided into 2 large groups: cellular and biochemical. Biochemical parameters of blood include such indicators as total protein, albumin, urea, creatinine, cholesterol, bilirubin, glucose, ions and pH. Among the cellular blood indicators the most informative are leukocytes, neutrophils, lymphocytes, monocytes, eosinophils, erythrocytes, hemoglobin, thrombocytes, ESR.

Influencing these indicators in patients with a violation of their normal ratio can achieve significant therapeutic effect. In most cases, this effect is carried out by chemical preparations that can have side effects or individual intolerance in the patient. Therefore, as an alternative, you can choose a more neutral way of action - using low-intensity laser therapy. It is performed by laser devices that emit light in the red and infrared ranges, causing the effect of photobiological biostimulation in the blood. Irradiation leads to various events: acceleration of wound healing, anesthesia, reducing inflammation, etc. The mechanism of action is assumed by means of the action of laser light on chromophores capable of absorbing light of a certain wavelength. Photobiological biostimulation can be caused both by direct absorption of energy by chromophores with subsequent improvement of the system's operation dependent on the state of the chromophore, and by subsequent reactions, for example, the effect of the laser is capable of expanding the vessels in this way. Currently, there are two main ways of affecting the blood by the laser, which are used in medical practice: percutaneous laser irradiation of blood (PLIB) and intravenous laser irradiation of blood (ILIB). Both methods have their merits and demerits, of which the main ones are the loss of radiation energy during irradiation and invasiveness. Loss of energy is the main disadvantage of PLIB, since irradiation occurs through the skin, which absorbs most of the energy, but this method is non-invasive, thus being absolutely safe. ILIB on the contrary, is invasive, which gives some contraindications for its conduct, such as low blood pressure, but its main advantage is the practically absent loss of irradiation energy.

Currently, helium neon laser with a wavelength of 632,8 nm has gained the most popularity in clinical practice. This laser has become popular due to its low cost and optimal characteristics, which are excellent for irradiating blood. However, other lasers such as gallium arsenide laser ($\lambda = 904$ nm) and ruby laser ($\lambda = 694$ nm) are also used in therapy, but they have not gained such popularity. According to the wavelength of the helium of the neon laser, it has specific chromophores, which are the main absorbers of its energy. The main cellular chromophores are hemoglobin in erythrocytes and mitochondrial cytochrome c-oxidase, which absorb in the red range, respectively, the target of light-cells that have them in their composition. The main biochemical targets: bilirubin, iron ions, ferritin and hemoglobin. The remaining biochemical parameters can change under the influence of lasers after physico-chemical reactions and enzymatic cascades induced by the energy of absorbed light. Thus, it can be noted that the main targets are proteins involved in energy metabolism of cells and iron metabolism. This enables the use of helium neon laser to accelerate the energy metabolism in the cells and normalize iron metabolism, which in turn will affect the general condition of the person and contribute to his recovery.

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SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY

(BIO-MONITORING, BIO-INDICATION, BIO-REMEDICATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT, INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

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SECTION 4

CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

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