Theoretical fundamentals of quantum medicine

1. BASIC PRINCIPLES OF MULTYFACTOR QUANTUM THERAPY

Magneto-infrared-laser therapy (Quantum therapy) has appeared in 80s of the last century. Quantum therapy is a multyfactor (combined) simultaneous influence of pulsed infrared laser irradiation, pulsed broad-band infrared irradiation, pulsating red light and constant magnetic field upon the biological structures of an object (patients, animals, plants).

The main therapeutic agent of Quantum therapy is pulsed infrared laser emission of As-Ga semiconductor laser diode. Laser infrared emission is monochromatic (narrow-band), space and time coherent and polarized and due to these features, has a powerful stimulating influence upon blood circulation, membrane cellular metabolism, activates neurohumoral factors, immune-competent systems; it harmonizes hormonal factors of metabolism.

Clinical effects of laser infrared emission:
- activation of albumen (RNA, DNA) synthesis,
- activation of ferments,
- increase of ATP output,
- improvement of microcirculation, content and functions of blood,
- regeneration of tissues,
- reinforcement of collagen synthesis,
- anti-inflammatory effect,
- antiedematous effect,
- anaesthetisating effect,
- cholesterol level reduction,
- stimulation of specific and non-specific immunity factors,
- powerful antioxidant effect,
- prostaglandin synthesis raise,
- lipids peroxidal oxidizing level decrease.

Pulsed broad-band infrared irradiation of semiconductor light-emitting diodes has lesser biological efficiency, as compared with that of laser emission, due to its wider spectrum, non-coherence and absence of polarization. It penetrates more deeply and exerts a harmonizing influence upon the central and vegetative nervous systems' tone.

Clinical effects:
- warming up of tissue structures of surface layers,
- acting upon skin receptors and increase of pain sensation threshold,
- microcirculation activation,
- prophylactics and treatment of cellulitis,

- epithelium and skin regeneration improvement,
- increase of laser penetration into tissues.

Pulsating red light, penetrating at a small depth, nevertheless has favorable influence reducing inflammatory process intensity in the skin and subcutaneous fat, especially in the zones with a lot of cellular tissue.

Besides, red light visualizes the treated zone and exerts local warming and favorable psycho-therapeutical influence.

Clinical effects:
- local anaesthetisation,
- improvement of microcirculation,
- antiedematous effect,
- expressed therapeutical effect in the area of joints having a lot of cellular tissue,
- prophylactics and treatment of cellulitis.

Permanent magnetic field turns molecular magnetic dipoles axes then increases internal energy of molecules. It enables also to keep dissociated the ionized molecules of the tissue, therethrough helping to increase efficiency of other agents of quantum therapy on the molecular and cellular level. Ionized molecules and cells of blood flow inside the vessels in the magnetic field, which makes them pin to the walls and form turbulence thereby increasing oxygen saturation of tissues and evacuation of residues.

Clinical effects:
- anaesthetisation,
- increase of energetic cellular potential,
- improvement of tissue trophism,
- antiedematous effect.

All the factors mentioned above, when acting simultaneously (in synergism) and reinforcing each other mutually, stipulate for unique effect of Quantum therapy as the physiotherapeutic medical and energy harmonizing prophylactic means.

At the same time, quanta energy of laser emission of the device does not exceed 1.5 eV, and it is not enough to cause ionization (dissociation) of organic molecules, disturb natural processes or to break biopolymer bonds. This assures absence of complications or side effects and high degree of laser safety of magnetic infrared laser device.

The depth of penetration into tissues is determined by technical parameters of the device, in particular, the wave length of impulse laser is 0.89 mcm. Biological tissues are optically the most transparent for the emission in near infrared spectrum.

Quantity of absorbed energy (dose) depends on presence and number of photoacceptors, i.e. the structures able to absorb the light of this wave length.

The power flow density of laser emission in W per cm^2 and the energy density in joule per cm^2, delivered to biotissues, are determined by the selection of frequency (5, 50, 1000 Hz or Variable).

It is generally believed that low frequencies serve the end of reparation and regeneration of biotissues, contribute to the cholesterol decrease, immunity raise and anti-inflammatory purpose, while high frequencies possess mainly analgesic, antiedematous and spasmolytic effects.

Frequency 1000 Hz is often used for laser puncture by means of a special light-guide nozzle.

2. PHYSICAL PRINCIPLES OF QUANTUM THERAPY

Physical-biological interaction mechanisms of biological tissues and low-intensive quantum emission cannot be considered studied enough, in spite of numerous scientific and practical researches.

The basic effect of infrared irradiation is a low thermal influence along with a high depth of penetration. Therapeutical effect is connected with the microcirculation reinforcement in biotissue, activation of molecules, potentiating of physical and biochemical processes.

Pulsating red light has higher quanta energy in comparison with infrared spectrum part (less than 2 eV), also not able to provoke destructive processes in tissues, but activates many processes in biologically active zones. Such zones are the ones with a lot of cellular tissue, for example, in the area of large joints, paravertebral sectors of Zakharin-Ged's zones and some others. Besides, skin circulatory and lymphatic systems are the immune-competent structures.

Constant magnetic field has the noticeable potentiating influence upon all the components of multifactor quantum therapy. It is known that in the organism, processes of molecule electrolytic dissociation take place in permanence, and simultaneously with dissociation processes occur recombination processes. Energy generated during dissociation is almost totally consumed for molecule recombination. And all the systems tend to a heat balance. Photoelectric effect, when the induced electromotive force achieves the values promoting dissociation, is reinforced by constant magnetic field that makes it possible to keep the molecules in this dissociated state during certain time. There appears some quantity of free energy, which makes non-radiating transitions in the intercellular spaces, on one hand, and contributes to the creation of temperature gradient in the bio-object structures, on the other hand. Besides, under magnetic field influence, dielectric permeability of biopolymers raises contributing to increase the depth of infrared irradiation penetration into tissues. Turbulent processes in circulating liquids intensify, too. Because of like charges repel one another, ionized liquid is retained against the channel walls more tightly, and consequently the metabolic processes are activated. Therefore, physical base of biostimulation effect in living organism at cellular, tissue, organ levels and at the level of the entire bio-object, is the

quantum irradiation influence upon atoms and molecules. As a result of the light quanta absorption, there occur electronically excited states of the atoms and molecules of the substance, with consequent migration of the electronic excitation, resulting in primary photophysical effect and in launching of secondary photochemical reactions

For better understanding of processes happening at the atomic and molecular level and launching the further succession of biological transformations, first of all, we should settle our attention on the technical characteristics of the magnetic infrared laser device and explain what they represent and what they determine in the process of Quantum therapy.

The wave length of infrared laser irradiation of arsenid-gallium diode is 890 nm. According to a number of Russian and foreign authors, such as A.V. Tcherkasov (1986), V.I. Matveev (1988), A.R. Evstigneev (1987), V.S. Sinyakov (1983), Joon and co-authors (1987), Muller (1990), T. Ohshiro (1988) and others, the depth of low-intensive laser irradiation penetration into bio-object mainly depends on wave length. To illustrate this dependence, we show a graphic representation of dependence of light penetration into biotissue (that is, of its optical transparency) from T. Ohshiro's monography (1988), (Fig. 1).

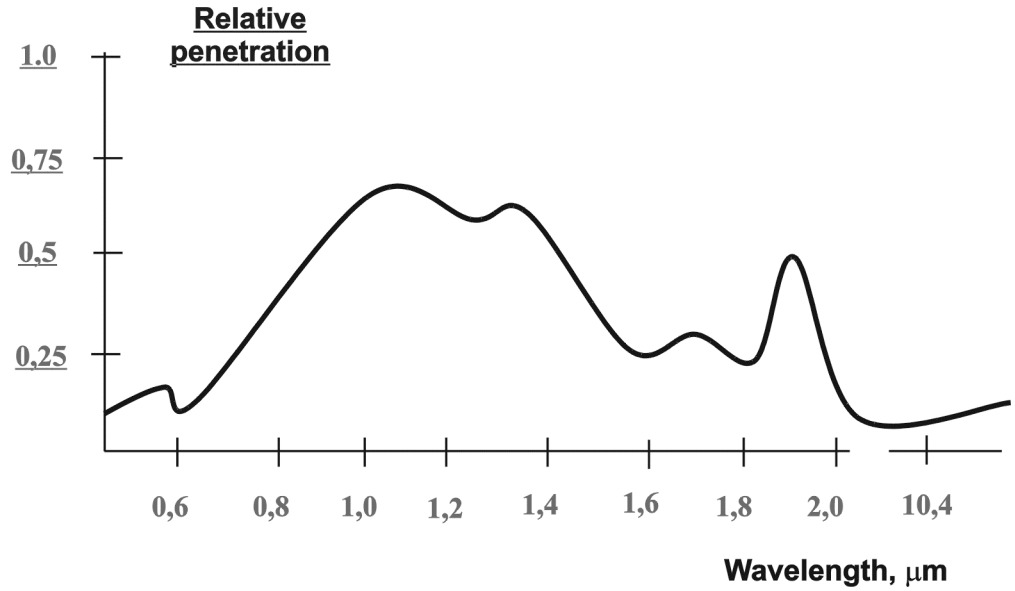

Fig. 1. Depth of relative penetration into biotissues depending on the light wave length.

Examining this curve, we can see that for near infrared diapason of spectrum biological tissues have the highest optical transparency. Hence, it is the laser irradiation wave length which, in the first place, determines the energy penetration depth into biotissue.

At the same time, photon energy of infrared region ranges between 1 and 1.5 eV. For comparison, energy of biopolymers' interatomic bonds is significantly higher. For instance, energy of bond (C=N) is 2.6 eV, energy of bond C-C and C=C is higher. Therefore, energy of infrared irradiation photons is not sufficient to damage strong intermolecular bonds of

biopolymers. But this energy is sufficient to stimulate oscillation processes in substance molecules and to activate electric excitement of atoms. Light energy is almost totally spent for photophysical reactions, e.g. is converted to thermal energy. This provokes thermal expansion of cytoplasm and membrane channels, catalyzation of biological processes, change of viscous-elastic properties of plasmolemma and intracellular membranes. The temperature gradient caused by the device irradiation is low enough (less that 1 grade) and never achieves the values which would be capable to cause irreversible changes of cellular structures (Fig. 2).

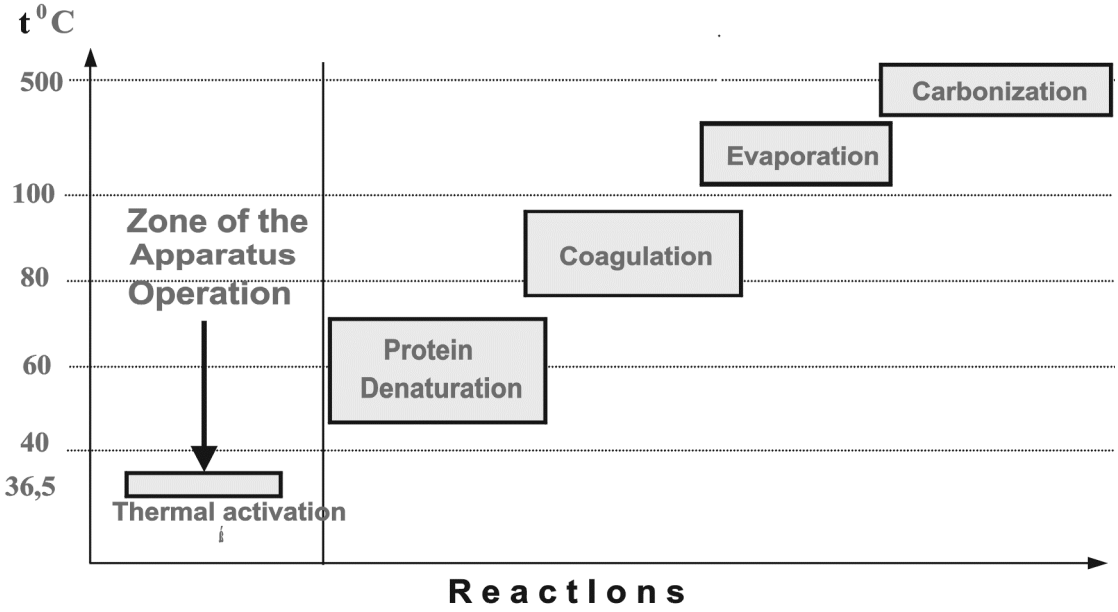

Fig. 2. Approximate thermal range of biological reactions according to T. Ohshiro

The wave band of wide-band pulsating infrared irradiation of the magnetic infrared laser device is about 800 – 900 nm. Quanta energy is higher than that of IR irradiation and reaches 1.6 eV. However, the irradiation being incoherent, non-polarized and broadband guarantees the absolute safety of its effect upon biotissues. Along with other medical factors forming Quantum therapy, this irradiation provides for more deep penetration of laser irradiation into biotissues.

Pulsating red light of 600 – 700 nm range has maximum photon energy about 2 eV. This energy is close to energy of carbon and nitrogen atoms' bond. When tissues absorb light of this wave band, the dissociation of molecules of the surface layer is possible, but there is no destructive process. Besides, pulsating red light visualizes the emitter operation thereby representing a powerful psychotherapeutic factor for a patient. It should be noticed that general toning-up effect of visible red light has become a scientific fact long ago (Fig. 3).

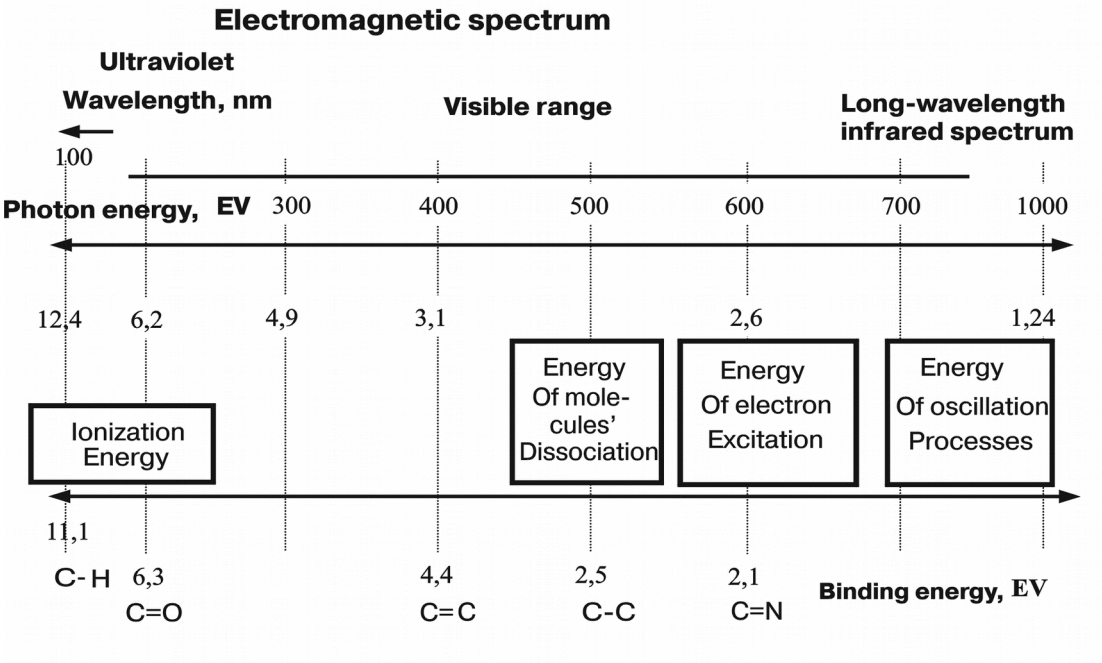

Fig. 3. Energy of photons and energy of
biosubstrate chemical bonds
(according to V.I. Kozlov, V.A. Builin and co-authors, 1993)

The inductance of constant magnetic field of the magnetic infrared laser device amounts to 35 ± 10 mT (millitesla). This field is enough for re-orientation of dipole molecules in the liquids, as well as in some ionized mediums. There has been theoretically grounded and practically proved that the biostimulation effect is enhanced in case of combined action of Quantum therapy components with physical characteristics of the magnetic infrared laser device as indicated above.

Pulse power of laser irradiation of the emitters (M1) of the magnetic infrared laser device is not less than 4 W, the same of the emitters (M2) is not less than 8 W. If the irradiation of such power were continuous, it would be a high-energy influence. But the device operates in pulse mode, and the duration of every separate impulse is 90 to 130×10^{-9} sec (nanosecond). During this time, comparable with the transient time of molecules, the energy fed to biotissue is enough to start activation and physical and chemical reactions. After the end of the impulse, a low fall of the activity of reactions on the atomic and molecular level takes place. It is well known that under external influence all the systems tend to recover their disturbed balance. If there is a deviation from the normal state of the biotissue, due to a pathological process, then the restoration of such a pathological balance would be harmful and the bioactivation should be maintained. So, in order to fortify the bioactivation, to realize positive biological changes and to oscillate harmful adaptive mechanisms at different kinds of pathologies, the device can generate different pulse repetition frequencies, namely: 5 Hz, 50 Hz, 1000 Hz, or variable frequency sweeping from 1 to 250 Hz. Quantity of energy delivered to biotissue with the selected frequency during a procedure is enough to maintain atomic-molecular transformations, to produce an increasing resonance effect and to enable mechanisms of prompt adaptation.

For infrared and red parts of spectrum all the laws of optics are valid (Fig. 4).

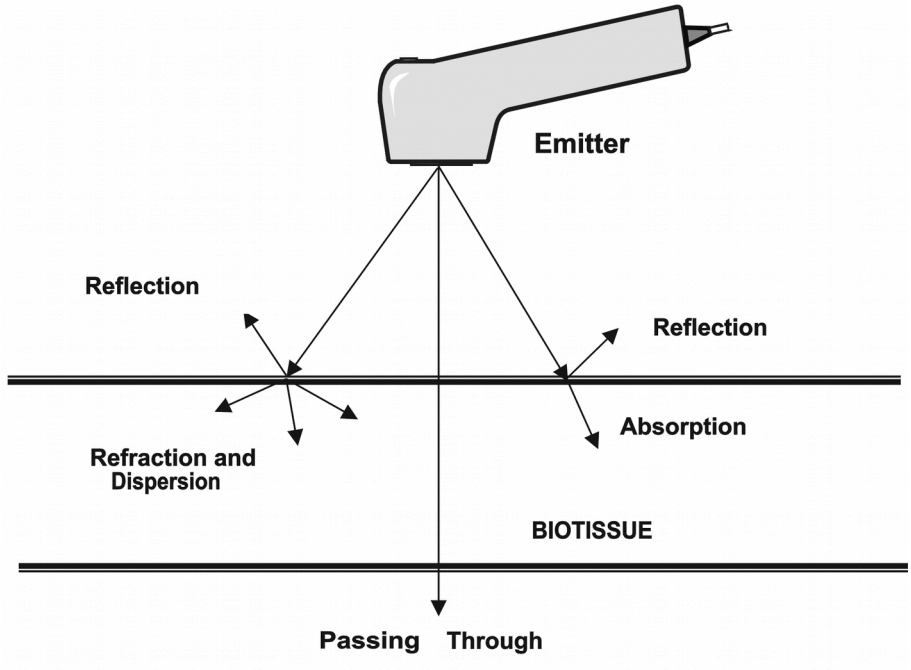

Fig. 4. Red irradiation passing through biotissue

In case of Quantum therapy there are 5 kinds of interaction between irradiation and biotissue:

1. reflection
2. refraction
3. passing through
4. absorption
5. diffusion

Reflection.

In infrared diapason the skin can reflect up to 40% irradiation, though there are some differences related to sex and age of a patient, his skin surface pigmentation, etc. It is possible to decrease the reflection by direct contact of radiating terminal with skin surface.

Refraction and passing through are not of biological importance. For IR-diapason it is the process of energy absorption by different structures of biotissue that is interesting. Experimental works by a number of Russian and foreign scientists have illustrated that for infrared irradiation in the range from 0.8 to 1.2 mcm the skin absorbs 25-30%, muscles and bones absorb 30-80%, and parenchymatous organs absorb up to 100% of irradiation.

It should be remembered that the final dose depends on the distance having been passed by irradiation in the air and in biotissue. In the air energy (the power flow density) declines inversely to the squared distance from the source to the biotissue surface (skin, mucous membrane etc). In the biotissue the reduction of power flow density goes very sharply and depends on the type of tissue. In case of biotissue irradiation through a bandage, every layer of bandage decreases the power flow density in 1.5 or 2 times.

“The sanitary norms and rules of lasers’ structure and exploitation” N5804-91 determine the terms, definitions, conventional indications and formulas for some values’ calculation.

For practical user the following values and formulas matter:

P_{imp} , i.e. impulse irradiation power in W,

E, i.e. irradiance, or power flow density (PFD) Wt/cm^2. The irradiance is irradiation power- to-area ratio where area is a surface perpendicular to the irradiation direction.

H, i.e. energetic exposure time, or energy flux density (EFD). The energetic exposure is the product of irradiance by the procedure time (J/cm^2). The values of E and H vary in proportion to the pulse repetition frequency f which is set on the device. For magnetic infrared laser device

$$E = \frac{P_{imp} \times \tau_{sec} \times f_{Hz}}{S_{cm}^2} \quad \text{mW/cm}^2 \text{ (or mcW/cm}^2\text{)},$$

where: P_{imp} is the power of impulse laser IR-irradiation;
τ_{sec} is the duration of one impulse;
f_{Hz} is the frequency of impulses;
S_{cm}^2 is the area of irradiation (at the contact method it is equal to the area of the emitter aperture, that is 4 cm^2).

Value of E determines the irradiance per 1 second.

Further on, for magnetic infrared laser device

$$H = E \times t_{sec} \text{ (J/cm}^2\text{)},$$

where: t_{sec} is the time of procedure realized at this frequency.

Dose Q – complete energy of a séance (J) (product of average power by séance duration)

$$Q = P_{imp} \times \tau_{sec} \times f \times t \text{ (J)}$$

On the basis of the above the calculation table for energetic exposure time of laser irradiation of magnetic infrared laser device of the basic modification (M1) is adduced below (Table 1).

Table 1.

Calculation of the power flow density (E) and energy density (H) for the magnetic infrared laser device with impulse power 4 W.

Frequency, Hz	E, mcW/cm^2	H, mJ/cm^2 t=1 min.	H, mJ/cm^2 t=2 min.	H, mJ/cm^2 t=5 min.	H, mJ/cm^2 t=10 min.
5	0.5	0.03	0.06	0.15	0.3
50	5.0	0.3	0.6	1.5	3.0
1000	100.0	6.0	12.0	30.0	60.0
1…250	12.0	0.7	1.5	3.6	7.0

Note: The table does not take into account the energy losses for reflection, dispersion, etc. The table is valid for contact method.
In the table there has been considered only impulse infrared laser irradiation. The other Quantum therapy components are biologically less effective and are not considered here. They lead to the reinforcement of bioeffect, contribute to better irradiation penetration into biotissues, but to determine H as an arithmetical sum of all kinds irradiation energy, which form Quantum therapy, would be incorrect. The magnetic infrared laser device allows adjusting of the average power of wide-band pulsating infrared and laser infrared irradiation from 0 to the maximum if necessary. In case of remote scanning irradiation, you should take into consideration the decrease of the power flow density that is inversely proportional to squared distance between the radiator and the skin surface.

The variation of H (energetic exposure time of laser irradiation) from 0.01 J/cm^2 to 1 J/cm^2 does not affect the optic properties of biotissue, i.e., the penetration depth does not depend on the power or energy flux density. For biophysical estimation of reactions taking place in biotissue and in organism as a whole, as well as for qualitative estimation of the influence of the activation magnitude (dose) of laser irradiation on the type of bioeffects, the Arndt and Schultz' law is of great importance.

It says that in biological systems slight stimuli provoke intensive reactions, medium stimuli provoke moderate reactions, moderately strong stimuli will slightly inhibit the system, and very strong ones will block it completely. The diagram presented below is a graphic illustration of Arndt and Schultz' law from the standpoint of Doctor T. Ohshiro (Fig. 5).

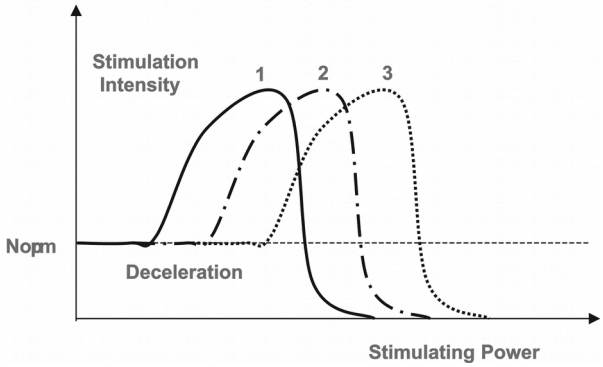

Fig. 5. Schematic interpretation of Arndt and Schultz' law,
the interaction of laser ray and biotissue.

On the diagram there is represented the state of a limited volume of biotissue cells (1), of a part of organ or a whole organ (2) and of the organism as a whole (3), which has been observed under effect of laser irradiation, going through some consequent stages. Firstly on the left, there is a zone of insensitivity (irradiation level is much less than exterior background level), when neither subjective nor objective methods allow to detect a primary reaction of the bio-object. Further on, when the dose (H) is increased, temperature starts rising in the tissues, which is considered as a zone of biostimulation until the level of 40°C. Letting tissue heat over 40°C would lead to albumen denaturing and lipids alteration, which at first can be reversible and play a positive role in final adaptation processes development. At the temperature over 55°C an irreversible albumin degeneration is observed, and at 63°C and higher occurs albumen coagulation. These phenomena can be observed when the high-energetic influence is used in some kinds of medical practice (oncology and others), which is not related to the magnetic infrared laser device absolutely. In physiotherapeutic practice we are interested in the part of Arndt and Schultz' curve from the end of the zone of insensitivity, which corresponds to the biostimulation state, and in the very initial part of the reversible activating bio-depression zone when there are no irreversible alternations.

As T. Ohshiro whites, technical parameters determine the "laser-biotissue" system reaction. Every kind of lasers will have a different Arndt and Schultz' curve. However, to draw such a curve for every kind of lasers does not seem possible; therefore the curve examined here is of qualitative nature only.

The Quantum therapy procedure duration can be determined with taking into account so called “therapeutical corridor”. This is the diapason of H when a less dose might result in a slight biostimulation effect or in a slowly increasing effect. At the same time a big dose is undesirable, as it causes an irreversible bio-depression.

For the device, Arndt and Schultz’ curve will have another shape. The insensitivity zone being preserved, the primary momentary reaction from IR-irradiation of small dosage (less than 0.02 J/cm^2) can be imperceptible at first, nevertheless, the appearance of prompt adaptation is often observed already at the doses from 0.03 to 0.1 J/cm^2 per a procedure. The majority of researches determine the stimulating dose rate from 0.2 J/cm^2 per a procedure (V.I. Kozlov, V.A. Builin and others) to 9 J/cm^2 (V.I. Eliseenko). It should be emphasized that such a large “therapeutical corridor” is typical for Quantum therapy, while laser emission only has a narrower one.

Let us remind once more that energy of photon of the IR diapason is too small to produce any hyper-temperature, denaturing, destructive or degenerative processes. However, the upper values for “therapeutical corridor” are quite actual for Quantum therapy as well, because the momentary stimulation processes are not endless. They are limited by the compensatory facilities of an organism. Undoubtedly, to realize the development of a predictable prompt and long-term adaptation alteration of an organism, it is more advisable to repeat low-energetic procedures cyclically, by repeated courses, than to prolong their duration or increase the power flux density of the emission.

Let us consider an effect, which is typical for Quantum therapy, namely the effect of increased biological influence of impulse laser irradiation upon an organism comparatively with the continuous irradiation at the same wave length and average power.

A great number of periodic publications and monographs dealing with the laser therapy indicate values of energetic exposure (“therapeutical corridor”) of laser irradiation H (J/cm^2) for continuous lasers. Numerous researches of many scientists have proved convincingly that the biological effect of the lasers of the same wave length manifests itself at the average power of continuous irradiation being significantly less than power of continuous irradiation, that is, its biological efficiency is higher. There is an opinion that this happens because of modulation frequencies coincidence with biorhythms of processes in organs and tissues. M.T. Alexandrov and co-authors (1987), having taken as an example the treatment of mandibular-facial region pathology, illustrated that impulse laser IR-irradiation has the same therapeutical effect as the continuous one, but at power K_{ef}=10 times less (K_{ef}. is coefficient of efficiency). This very phenomenon is described in the works of a number of authors who indicate a higher therapeutical effect when the impulse irradiation is used. They state the effect is seven-tenfold stronger. V.I. Korepanov (1995) proposed to assume K_{ef} (coefficient of efficiency) for the magnetic infrared laser device equal to 8. Therefore, the doses recommended for continuous laser in some literary sources should be 8 times diminished approximately in order to be applied for calculation of a dose for the magnetic infrared

laser device, necessary to obtain the same effect. Or, having calculated the energetic exposure of laser irradiation (dose H, J/cm^2) per a procedure using the table for the magnetic infrared laser device, you could compare it with recommended values of “therapeutical corridor” for continuous irradiation, if you multiple this empirical value by 8.

Now we conclude the examination of physical characteristics of the magnetic infrared laser device and brief physical grounds, which are necessary to a user for understanding of processes taking place at atomic-molecular level and determining further cellular, tissue and other transformations when the device is used. You can amplify your knowledge on the subject by turning to the literary sources.

3. BIOLOGICAL PRINCIPLES OF QUANTUM THERAPY

The photophysical and photochemical reactions underlie the biological processes in the body tissues. The photophysical reactions are mainly conditioned by heating of tissue and non-radiating spreading of heat inside tissues. The photochemical reactions are associated with the movement of electrons at different atomic orbits of a light absorbing substance.

The depth of penetration of laser irradiation into the biotissues of the human body depends on the wave length. In the diapason corresponding to the near infrared irradiation, namely about 0.74 to 3.0 mcm (740 to 3000 nm), the biological tissues are considered optically transparent. This transparence is maximum within the interval from 0.8 to 1.0 mcm (A.R. Evstigneev, 1987). The phenomenon of biotissue optical transparence in the infrared spectrum has been confirmed repeatedly by works of Russian and many foreign authors (Fig. 6).

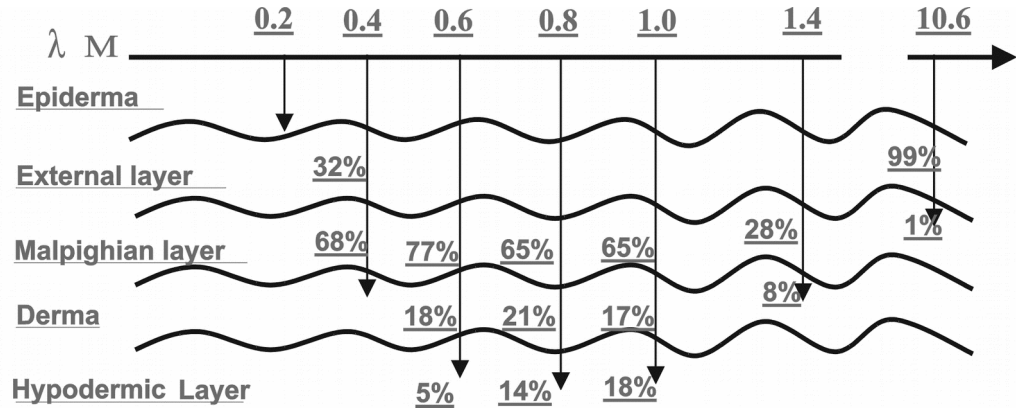

Fig. 6. Depth of penetration of the laser irradiation through the human skin surface (Sliney D., Wolbarsht M., 1980) taken from the manual “Lasers in clinical medicine” edited by professor S.D. Pletnyov. Medicine, Moscow, 1996.

The irradiation penetration depth depends also on its absorption by different tissues. Particularly, skin, subcutaneous cellular tissue and muscles absorb 20 to 30%; bones absorb about 50% and parenchymatous organs absorb up to 100% of energy.

To compare, laser irradiation of devices operating in visible light diapason, for example, 0.63 mcm, penetrates into biotissues to the depth about 15 mm and looses its coherence and polarization already passing through few initial millimetres (V.S. Sinyakov, 1983).

In the human organism there are two categories of photo- (light-) depending structures:
the first structure is photoreceptors, namely a specific light-sensitive biotissue represented by eye's retina;
the second structure is a big group of photoacceptors.

Because of their properties, the photoacceptors are able (to either extent) to absorb the light quanta of a certain wavelength. Among them, there are haemoglobin, cyclic nucleotides, iron- and copper-containing ferments of cytochrome system, almost all the ferments of Krebs's cycle, some pigments and other structures.

For the device (λ = 0.89 mcm), the main absorbing component of organism is the blood. The concentration of energy absorbed by blood exceeds several times all the other values (V.G. Dobkin, 1989).

Another photoacceptor of infrared laser irradiation is water. Water in the body is in the state of continuous microphase gel-ash content conversions. Bound water (mainly with albumen molecules) makes up just about 5%, every aminogroup binding 2.6 water molecules (V.I. Kozlov and others, 1993). Under laser irradiation, water electroconductivity, pH, as well as oxygen solubility in water undergo changes (K. Kamikava, 1988).

Another aspect of infrared laser bio-effect is its influence upon oxygen. As a result of photon absorption, molecular oxygen converts into very short-living singlet oxygen $^1O_2$. In spite of short life period, it is very active biochemically, especially regarding the membrane plasmatic complexes.

One of the main biological effects of laser irradiation is the effect upon K' – Na' co-transport inside and outside the cell (A.M. Moroz, 1989). This contributes to fast diminishing of cellular and tissue oedema.

In infrared spectrum the photon energy fluctuates within limits of 1 to 1.5 eV. This is enough for the atom electronic stimulation and the oscillating processes activation in molecules. Light energy turns into thermal one almost totally, leading to a thermal expansion of cytoplasm and to the change of cellular and intracellular membrane properties (V.I. Builin, 1993). We remember that the light quanta of infrared diapason cannot energetically disturb strong bonds of biopolymers. This explains the absence of negative affect of Quantum therapy upon the organism if there is a wide "therapeutical corridor".

A peculiarity of the infrared diapason irradiation is the absence of resonance absorption of these photons by biotissues. The resonance absorption appears if energy of quantum is equal to the energy difference between an atom in its normal state and the lowest level of stimulation. Energy of quantum at the wavelength 0.89 mcm (magnetic infrared laser

device) does not reach this difference. However, it is possible that because of the absence of resonance absorption, IR–irradiation penetrates into biotissues more deeply and provokes the photophysical reactions on membranes. As a result of a temperature gradient occurrence, a thermo-diffusion outflow of K' and Na' from membranes occurs, membrane channels open, ions come out of the cells tending to restore the electrochemical ionic balance, unbound water exits the cells, potential cellular energy increases (M.A. Kaplan, 1989).

This is pertinent both to the structural organic cells and immune-competent cells of blood and tissue structures, histiocytes, fibroblasts, leukocytes, lymphocytes, etc. As a result of the specific cellular structure activity, the immunoglobulin level rises, activity of ferments, the nervous synapse mediators, estrogens, 17-oxyketosteroids, prostaglandins and β-endorphins increases, ATP accumulation proceeds and other biochemical transformations take place. The following diagram (Fig.7) shows this multi-stage process:

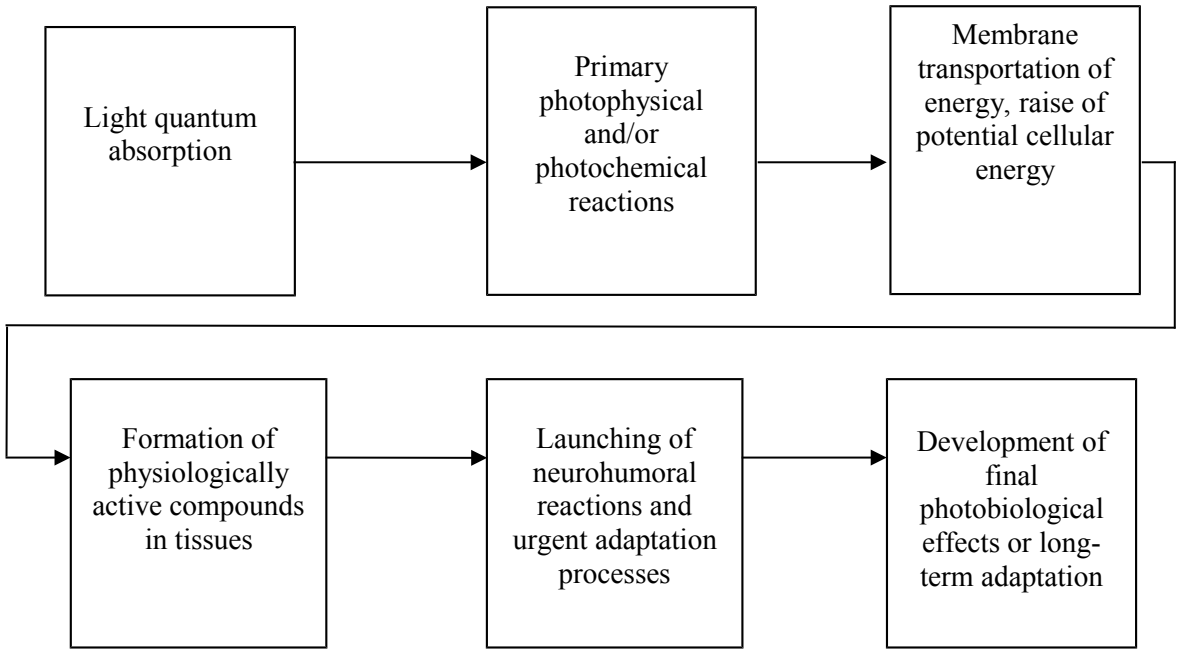

Fig. 7. Block diagram of biochemical transformations

V.I. Matveev (1988) divides the bio-effects into three categories relatively:

I. Primary effects which are not often registered subjectively for infrared diapason. Special biochemical and biophysical methods could make them objective.
II. Secondary effects: development of urgent adaptation and compensatory reactions, which occur as a result of the primary effect realization.
III. Effects of "post-action": development of long-term adaptation, constructivation of the pathological process flow, strengthening of compensatory reactions.

The components of this process work dependently on the momentary situation in the organism related to the course of a concrete pathology, but

not on the very photo-effect. The launching mechanism snaps into action, while the compensatory facilities (possibilities) of the organism are preserved. The succession of transformations is launched, and the organism itself realizes adaptation reactions. That's why the primary acts are so few and the secondary effects and final results are so various and exceed the most audacious forecasts and expectations in the upshot (V.I. Kozlov and co-authors, 1993).

A diagram from the book “The Principles of Laser Physio- and Reflexotherapy” (1993) by V.I. Kozlov, V.A. Builin and co-authors could be a sketchy illustration of the above-stated (Fig. 8).

The diagram does not comprise all the known bio-effects of the low-intensive laser radiation (LILR). Besides the components shown on the diagram, there is a hypocholesteremic action that is an important factor in the therapy of many pathologic processes including atherosclerosis.

A strong antioxidant effect has been proved. The Quantum therapy effect at non-invasive blood irradiation is the more expressed, the higher is the acidosis level.

A well pronounced reflex effect upon the intestinal peristalsis and many others are of significant importance. However, within the limits of this manual we consider possible to restrict ourselves to the adduced data, which are useful for any user.

We recommend the readers to apply to special original sources, monographs and magazine publications.

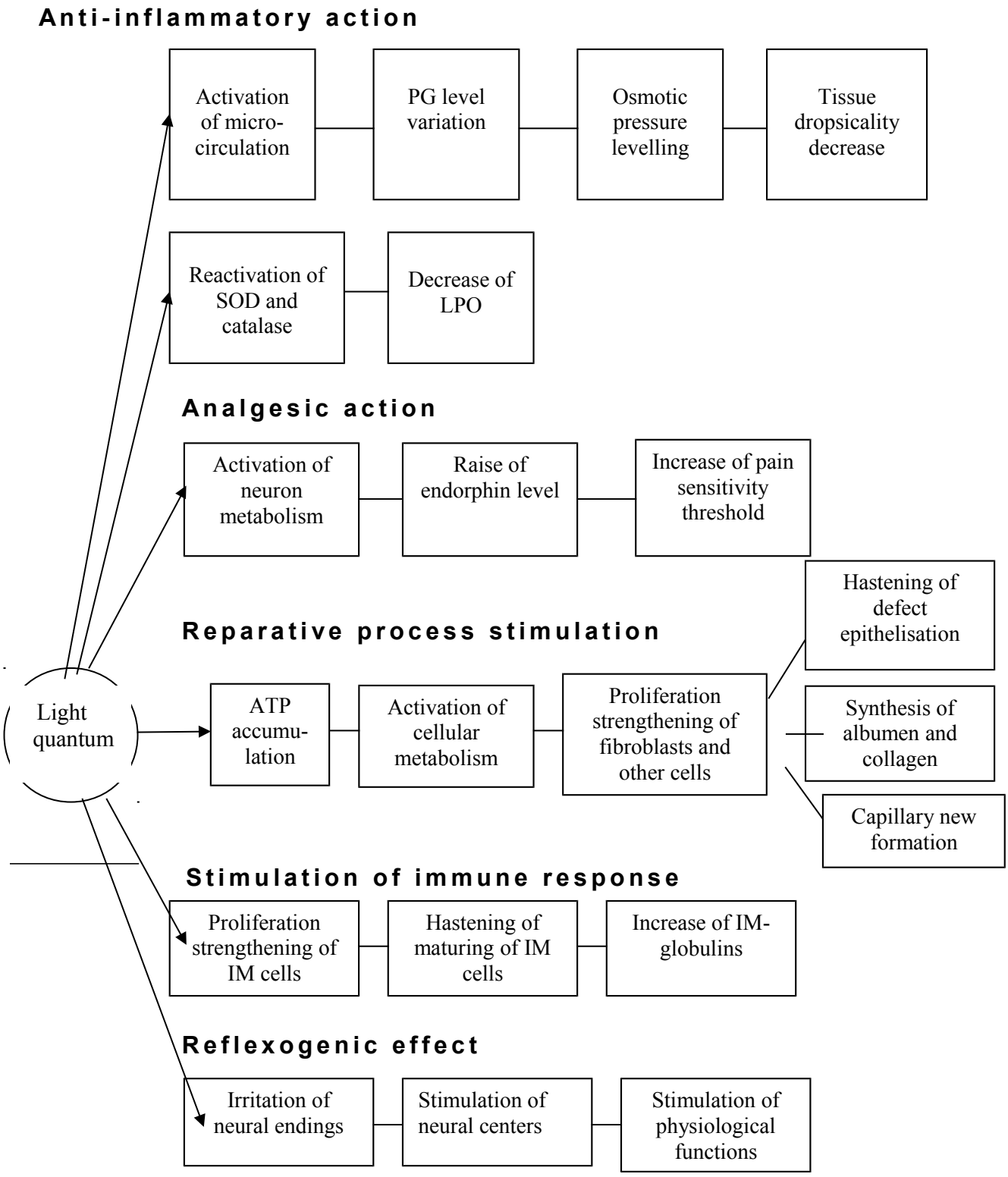

Fig. 8. Photoactivating processes in the organism.
PG – prostaglandins, SOD – superoxidismuthase, LPO – lipid peroxidal oxidising,
IM – immune.

Biostimulation, namely its intermediate and final results, which consist in development of urgent and long-term adaptation processes, depends on the momentary health state of an organism and its compensatory facilities to more degree, than on the photo-effect itself. It is obviously that the light quanta absorption by biotissue elements launches a number of various biochemical reactions and biological displays. These processes depend on both the physical characteristics of concrete device, namely on quantity and quality of energy delivered into tissues, and, mainly, on the compensatory mechanisms and all the adaptation systems available in every specific case. At the total paresis of these mechanisms, a positive decision regarding laser therapy is problematical. If the compensatory facilities are preserved, a positive decision on Quantum therapy application is possible, but some circumstances should be taken into account; for example, in case of significant increase of dosages (raise of Exposure times, application of unnecessarily high frequencies, etc.), contemporary researchers describe a state, which some authors named as “laser disease”.

The data of investigations testify that this state, manifested through an exacerbation of some symptoms of main or attending diseases, is typical for over-dosing of laser influence. If there is a pathological process, normal and pathological structures and functions co-exist in the organism. There are several reasons of “laser disease”. One of them could be an exhaustion of adaptation mechanism structure elements’ because of non-adequate dosage: deficient antioxidants, surplus of singlet oxygen, appearance of soluble collagen excess with the copper ions’ binding (A.K. Polonsky with co-authors, L.I. Mamontova, 1996). Another possible reason is a photo-activation of structures both functioning normally and pathologically. Obviously, the enumerated reasons of possible exacerbation are not comprehensive, but they explain quite really the mechanism of its appearance at the over-dosing of energetic effect.

Some authors consider that the process exacerbation indicates a significant potential of immune and other compensatory systems. These resources assure a fast attenuation of the “laser exacerbation” symptoms at the prophylactic prescription of antioxidants, dosage reduction, etc. In case of Quantum therapy, we use extremely low energy levels. The above stated methods, the indicated frequencies and time do not cause worsening of patient's state, with a high degree of credibility. However, we should admit a possibility of some patients’ individual hypersensitivity and supervise carefully the reactions occurring during the Quantum therapy course.

Most of the zonal Quantum therapy methods are contact. The works of I.N. Danilov (1985), T. Ohshiro (1988) have proved that the contact method increases the intensity of laser irradiation passing through biotissues 40 times for λ = 0,63 mcm and 3 times for λ = 0,83 mcm in comparison with the distant irradiation. This is obtained due to a certain outflow of blood and a raise of tissue transparency when the device terminal is pressed to the treated area, as well as because of the retroreflection of the irradiation, that had been reflected from the skin, by the inner walls of the emitter.

The last years experiments have proved that the curing effect of Quantum therapy will rise significantly if intervals are made during the procedure; it is advisable to do a pause of 2 or 3 seconds after every minute of a procedure, if the influence upon one zone amounts to several minutes (S.D. Pletnyov, A.K. Polonsky, 1996).