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BIOSTIMULATION THROUGH LASER RADIATION AND BIOPLASMA

BY V.M. INYUSHIN AND P.R. CHEKEROV

TRANSLATED BY
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THE DANISH SOCIETY FOR PSYCHICAL RESEARCH
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STIMULATION THROUGH LASER RADIATION AND BIOPLASMA

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ntents:

Author's note	page 3
Briefly about lasers	6
Unspecified action of laser rays on living organisms	11
Physiological action of monochromatic polarized red light on peripheral blood and blood-forming organs	24
The reaction of endocrinal glands during radiation by monochromatic red light	28
Stimulation of regeneration by monochromatic red light	37
A word about bioplasma	49
Biostimulation through laser radiation through acupunctural points	75
Conclusion	1o5
Bibliography	116

:roduction:

Optical quantum generators (lasers) are one of the most significant ɪievements of technical throught during the second half of the 2oth ɪtury. In this book are presented the physiological action of liation by helium-neon lasers. Data is given on the dynamics of ʏsiological and histochemical properties of tissues under the influence laser radiation. Light is shed on the little-known aspects of using ɜer radiation clinically as a factor for stimulating the nervous ɜtem during treatment of neurological diseases and diseases of the ɔor system. Special attention is given to presenting the problem of a bioplasma connected with the treatment of the action of laser light. .s monograph is meant for doctors, tecnicians, teachers of biology, lical and agricultural students, veterinary surgeons, medical ɜtitutes, biological faculties of universities, and research workers.

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INTRODUCTION TO THE ENGLISH EDITION BY THE TRANSLATION EDITORS

THIS BOOK, which was printed in the USSR in the spring of 1975 (an edition of only 4000 copies) contains the latest information on a number of research fronts: Kirlian electrophotography, acupuncture, research into the existence of "bioplasma", and the new science of biostimulation by ultra-weak laser light. Brief mention is also made of other research, we can call parapsychological, which the soviets call psychoenergetics, and of heliobiology, which is the study of rhythmic functions in the biosphere, and their supposed extraterrestria (i.e. solar) causes.

Although in the original monograph there are only 115 pages, because of the complexity of the material, it has taken us over a year to translate and edit the material. Why have we taken so much trouble, especially since we have not had the backing from any publisher or financial sponsorship of any business interests?

It is our opinion that the material in this monograph is of utmost importance to scientists around the world. The only one of the fields covered in this book which has been at all circulated in western scientific circles is the Kirlian process---due to the interest of a few parapsychologists who have used the technique for psi experiments. Even this material---as is revealed in the conclusion of this monograph has been misunderstood, garbled, misrepresented, and lightly dismissed by the scientific establishment. One reason is the misinterpretation of the concept of "bioplasma", which is the pervading theme of this book since it is often invoked as the underlying medium of energy exchange and transformation in biosystems. Although there may be some doubt about the "proof" of the existence of "bioplasma", in this work Inyushin and Chekorov give the best theoretical description to date of the composition of "bioplasma", and the experiments which they feel point to the existence of such a substance.

Certainly the most neglected area covered in this material is the problem of "weak resonance biostimulation." Since this material is not primarily parapsychological in nature, it has not been picked up by the parapsychologists who so eagerly reported on electrophotography. Nor has it been picked up by the scientists who should be most interested in it: the laser scientists, medical doctors, and biologists in the west who pioneered in the application of high-power lasers in medical treatment (1,2). In fact, western scientists seem completely ignorant that there are any effects at all due to non-thermal influences of light on biosystems. The greatest part of this book is devoted to the problems of biostimulation by laser (and other types of) light.

While it has been known for some time that the Soviets had an intense interest in acupuncture, it has not been clear until now exactly what they were doing. In this book, the longest chapter is devoted to biostimulation through acupunctural points, and a considerable amount of clinical data is presented for the first time. A fascinating addition is the use of weak light stimulation at acupoints in addition to the usual needling techniques.

One of the most interesting scientific turn-abouts of this century has been the sudden change in the status of the so-called mitogenetic radiation, discovered by the soviet scientist A.G. Gurvich in the 1920's. A survey of the Gurvich controversy up to the year 1949 is given by the dutch scientist S.W. tromp in his book "Psychical physics" (3), and we have brought this up to date from other sources. Although some scientists were able to reproduce Gurvich's experiments with "living detectors", others failed, and attempts at using sensitive light detection systems failed also.

Gurvich's work fell into disrepute both within and without the USSR. As late as 1960, a doctoral dissertation by M.N Moyceyeva totally rejected the existence of mitogenetic radiation. It was not until 1966 that V.S. Konev et al (4) succeeded in showing that the radiations from the cell cultures was so weak in the UV band that it could easily be absorbed in the apparatus which was used to measure it! (for example, by using glass lenses instead of quartz). In 1974 A.A. Gurvich published results of an experiment with hops, point out the errors which had made the existence of mitogenetic radiation doubtful in the intervening 50 years. Prof. V.P. Kasnacheyevat the Leningrad Brain Institute, since 1967 has been doing experiments in "cell communication" in the UV band, which stem from the original Gurvich work (5) The Czech professor Sedlatchko has also replicated the work, according to accounts we have received. (these will be translated separately by us and can be ordered using the form in the back of this folder).

Apparently independently of the latest wave of Soviet change of mind, two western researchers, Quickendon andHee (6) in 1973 successfully replicated the Gurvich effect with yeast cells, using sensitive photo-multipliers in the UV band and quartz windows.

This research underlies the whole thesis developed by Inyushin and Chekorov in this monograph---that light in biological systems plays an organic rôle, and can be measured by appropriate instrumentation.

In the meantime, we have received supporting documentation from the USSR and elsewhere regarding verification of some of the research results presented in this monograph, and giving further technical and clinical details. This material will be available shortly for distribution.

A few words about practical matters regarding this translation:

In some cases, where there is doubt about the meaning of the russian word, we have given more than one translation, the second or third meaning being given in paranthesis (brackets). Where the material is especially difficult, we have added occasional footnotes at our discretion. In a few cases, we have omitted redundant passages, but these are clearly marked in the text. Immediately following the conclusion is the translation of the original Soviet bibliography given by Inyushin and Chekorov. Immediately following this is a western bibliography compiled by us, which fills out the gaps in the original references, giving articles in English and a few other languages on related research.

We are very interested in receiving constructive feedback on this manuscript and for this prupose have included a form at the back of the folder. If you find any errors, spelling mistakes, etc. use this form to tell us about it.

Scott Hill
T.D. Ghoshal
Copenhagen, Sept 1976

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1) Hill, Scott: "Acupuncture Research in the USSR" American Journal of Chinese Medicine, 1976, Vol , Nr , pp.
2) Barnes, Frank: "Applications of Lasers to Biology andMedicine" Proc. of the IEEE, vol 63, Nr 9, 1975 (interesting for its omissions)
3) Tromp, S.W. "Psychical Physics", Elsevier, Amsterdam 1949
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A WORD FROM THE AUTHORS

Above all, it is our wish to explain to the reader how the idea of resonance biostimulation appeared and why it is connected with bioplasma. Here we wish to reminesce a bit of the past. More than 5o years ago professor A.G. Gurvich discovered the existence of mitogenetic radiation (rays radiating from cells during their division in the UV band of the spectrum). An amazing fact was arrived at, viz. that single photons were able to make the quiescent cell divide. In its turn, the dividing cell stimulates the neighboring ones with its rays to undergo a process of cell division.

Many theoretical works on the problem of mitogenetic radiation have been published, but not a step has been taken for their practical utilization in the fields of medicine and agriculture. The mechanisms of intercellular ray reactions remained a puzzle, there were no clear picture of the physiological role of radiation. There were no good experiments to extablish the existence of the biofield. (A.G. Gurvich, 1944).

We shall fully explain the turn such a crisis took. It was connected with the unsatisfactory level of development in certain branches of physics, the weakness in the development of biophysics. The chasm between physics and biology existed for a long time and prevented ideas from meeting, as the experience of the natural sciences shows. A whole series of new facts, theories, and separate courses of development came to life. Enthusiasm for the analytical aspects of biology was also a reason for "a cool attitute" towards problems which A.G. Gurvich began developing. The very essence of the work of the school of A.G. Gurvich was to demonstrate that with the aid of radiant energy of low intensity it was possible to control biological processe This, on the face of it, is the phenomenon of resonance. When the space-time parameters of the radiation of the donor and the recipient (in the case of their convergence) induce this or that process. Even an insignificant change in these parameters such as, for example, the frequency of radiation, brings about the deterioration of the effect. Consequently, resonance biostimulation is an amplification or actually the aceceleration of metabolic processes under the influence of the radiation of definite parameters (wavelength, polarization, modulation, intensity, etc.)

In the very core of the experimental material amassed by the Gurvich school, the idea of resonance biostimulation took its form. The idea got its concrete development at the faculty of biophysics of the Kazakh State University and has gained the successful approbati (approval) under clinical conditions. It is neccessary to mention that the regulation of processes based on the mechanism of resonance biostimulation are only possible with the knowledge of the energy structure of the whole organism, since, in fact, the whole constitutes the norm of all the countless processes taking place at every second, in the living organism. As is known, biochemists and biophysicists already know a lot about the properties of molecules, comprising the organism. A new branch has appeared, that of molecular biology, however one should not forget that the molecular level represents but one of the levels of organization, and life is a tightly intertwined system of different levels governed by the laws of the whole. As the Nobel prize laureate, A.St. Dierdri remarked: "The composite level is the most complex and difficult to study. It is namely at this level that the fascination and capriciousness of life phenomena manifest themselves." It is difficult not to agree with the words of this famous scientist. The discovery of bio-energetic processes conditioning the entirety of the living organism is the key to understanding many problems.

And when, in our book, we speak of the possibility of directed influenc on the organism, in a pathological state, we depart from the original concepts about bioplasma. Bioplasma is a plasma (4th state of matter in physics) under conditions present in the living organism. It is namely through it that the resonance action of radiation of defined parameters is realized. Such radiation can only be obtained withthe aid of lasers, that is, optical quantum generators. In the U.S.A., England, France high-power lasers are succe ssfully being applied in surgery, ontolgy, etc. The Kazakh State University is the pioneer institution in the utilization of the laser radiation of low intensity in biology an medicine. A completely new sphere of applying radiation ergy to control the reaction of changing propertes has been acheeved. The idea, as we have mentioned above, has its historical roots in our native science. Here we may add that in the fiel of chemistry, successful experiments in controlling shemical reactions with the aid of gas laser radiations based on resonance interaction between the radiation and molecules have successfully been carried out. (N.G.Basov, etal, 1973). It is obvious that the resonance effects of stinulation are not characteristic, or special for a living organism. At the biology faculty of the Kazakh State University named after S.N.Kirov research made on resonance biostimulation with the aid of light, on biological processes were begun in 1965. Since thet time, 9 years have elapsed. During that period, experimental work has been supplemented by scientific and practical bodies: the Alma-Ate state medical institute, the "Akaay"Republican child clinic of the ministry of health of the Kazakh SSR, the republic clinical hospital of the ministry of health of the Kazakh SSR, the town child hospital of Alma-Ata, the Kazakh scientific research institute of tuberculosis- the Tselinograd medical institute, the Lvov medical institute, the Moscow medical institutend and others.

The results obtained show that biostimulation with the aid of laser lighet holds many practical applications.

The significance of resonace biostimulation methods and the problems of bioplasma were widely discussed at the republic conference "Proble of the bioenergetics of the organism in normal and pathological state which took place in Alma-Ata in May 1971.

The time has come to sum up the research presented, and theoretically ponder over the experimental material. Such has been our task in writi this book. Many sections were written on a discursive level. The theoretical opinions are often original and may evoke objections and criticisms. This is quite understandable, since we are confronted by a co pletely new sphere of medical and biological scien where, as yet, there are no established cocepts and obvios theses.

A FEW WORDS ABOUT LASERS

A lot has been written about lasers, predominantly about the high-power ones, since the low-powered gas lasers were for a very long time not utilized in biology and medicine. In the meantime the family of lasers is growing. Eventually, thanks to lasers, it was possible to achieve a resonance biostimulation of processes taking place in the organisms of living beings and man. That is why we have thought it an idea to describe their construction and applications in biology and medicine.

Optical quantum generators (OQG's) received the acronym Laser. The word "laser" is made up of the first letters of the English words: light amplification by stimulated emission of radiation. Depending upon the nature of the light generated, lasers can be divide into three basic groups: gas and ion, whose stimulation is brought about by an electrical charge, those with an optical pumping on the crystals, glass, liquids, and plastic; and semiconductor lasers.

Gas lasers: Gas optical quantum generators give the most monochromatic light radiation. At present, progress in the constructic of gas lasers has gone very far. Gas optical quantum generators have been constructed that radiate light on hundreds of different wavelength ranging from ultra-violet to infra-red.

Let us examine the principle of construction of a gas He-Ne laser which is operated continuously. The basic active element of a gas OQG is the discharge tube. Within the tube is a cathode and an anode, the tube itself if filled with a mixture of helium and neon. The partial pressure of He amounts to about 1 mm Hg, and the Ne of 0.1 mm Hg. Under the influence of high pressure, a luminescent discharge takes place in the tube. The generating source of radiation is Ne, however the stimulation of atoms is achieved with the aid of the He atoms. The stimulated He atoms, colliding with the Ne atoms give off energy to the latter, which is indispensible for them in turn to attain an excited state. In this way, an active medium is created in the tube, composed of Ne atoms, possessing inverted populations in the electron energy levels. The spontaneous radiation of the separate Ne atoms brings about a dispersal in the active medium of photons, corresponding to the electron displacements in the neon atoms from 3 S to 2P level. In the He-Ne gas laser one of the electron displacements $3S_2 - 2P_4$ is used. Further, an induction of coherent radiation of other excited Ne atoms takes place.

The chain reaction of this process is insured by the tube being placed in a mirror resonator. The frequent path the light takes down along the axis of the discharge tube brings about the formation of a powerful current of induced, trained, coherent radiation, characteristic of a gas laser. Such multiple paths taken by the beam is achieve with the help of reflecting mirrors. The discharge tube is enclosed by plane parallel glass plates at each end, fixed at a definite angle to the tube. (i.e the Brewster angle---Eds.). No radiation takes place through these windows without reflective loss. The mirrors of the resonator are covered by many dielectric coatings. They possess high reflectivity, 98-99%, and consequently, absorb very little light energy, passing through the mirror. The transparence of the mirrors is optimal for the laser being able to emit a powerful current of radiation without noticeable decreases in the mirror resonator in which the system of standing light waves of [illegible] is created.

Soviet industry is producing a series of He-Ne gas lasers (OQG's) [illegible] different types of generators presented in table one are used in

Solid-State lasers

In ruby lasers, polished ruby rods are used. For optical pumping, an impulse lamp is used. For the generation of light of a given parameter, the laser has a resonator. In the simpler types, the resonator is represented by two semi-transparent mirrors placed towards the periphery of the active medium. The mirrors force the photons to disperse perpindicularly to their surface, and frequently pass through the amplifying medium.

This causes the appearance of new excited particles in the medium, subsequently, the whole totality of photons is amplified anew, when they pass between the mirrors. This process brings about the appearance of a powerful directed light impulse in a narrow waveband interval. Since one of the mirrors is semi-transparent, a very strong current of brilliance goes through it in a perpendicurlar direction in relation to the mirror surfaces. All the quanta radiated strictly correspond in phase and frequency---i.e. they are coherent.

The solid-state, ruby impulse laser has found wide applications in biology and medicine. The radiation generated by a ruby laser has a wavelength of 6943 Å, the power of radiation may vary within wide limits. The highest light impulse energy was obtained in the region of 1500 joules. The utilization of microscope lenses enables the area of the spot to be reduced to tenths of a square micron. At the present time, a constant plan of work for ruby generators has been worked out. The radiation energy of such a laser comprises a few milliwatts (mW). With the help of such a laser it is possible to obtain non-thermal biological effects of radiation, on a wavelength of 6943 Å. However, the radiation area of solid-state lasers is larger than gas lasers.

Solid-state and gas lasers generate light on definite wavelengths. Diagram 1 shows the area of the electromagnetic spectrum from 300-1200 Å, that is, from the ultra-violet to infra-red band. The emission lines are many, but there are also blank spaces (i.e. the so-called forbidden transitions---Eds). In connection with this the fact that for purposes of spectroscopy, chemistry & biology, a very accurate calibration is required for this or that line of absorbtion. New types of properties were discovered in quantum electronics, with the aid of which it was possible to cover the whole band of the light spectrum and obtain the generation of radiation on any wavelength in the band sector. Such properties were discovered---they turned out to be organic dyes. Up to the present time, the generation has been dicovered in several hundred compounds.

In the institute of physics of the academy of scienees of the Belorussian SSR, a dye laser called "Raduga" (Rainbow--Eds) was constructed. (V.I. Stepanov, A.N. Rubinov, 1973). Its layout has been shown in diagram 2. The radiation of a ruby laser (1,2,3,4) takes place through a cylindrical lens (5) and a non-linear crystal (6) and doubles in frequency. Further, the light current of doubled frequency, wavelength 3470 Å, is focussed on a dye chamber, in the form of a narrow stripe, stretched across the lower part of the cuvette axis, In this way, the pumping of the dye is accomplished. The generation of radiation takes place in a perpendicular direction in the resonator, formed by the mirror (10), and the diffractional grating (8). Ten grooves, filled with solution of various dyes, have been designed in the apparatus. The grooves are fastened in a special revolving cylinder (drum) which enables the rapid change-over from one dye to another. The easy shifting of the generation line is obtained by the simple rotation of the diffractional grating (8). Such a laser enables the attainment of light impulses ranging in

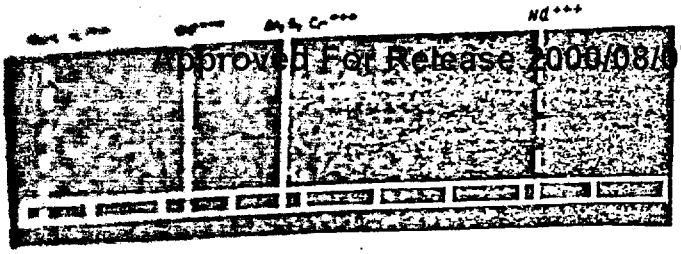
power from hundreds of kilowatts to a few milliwatts, and in any waveband from 3600 Å to 10,700 Å, the spectral line being of a width of up to 50 Å. In the not-to-distant future, biologists will have an instrument for the induction of widely-differing effects during stimulation and inhibition of metabolic processes. Even now, lasers have been constructed based on dyes, in which a rapid spectrum change-over is achieved in 10^{-5} seconds. Such a property of a laser will doubtlessly find a wide application in the rapid spectroscopy of bio-objects, above all in diagnosis.

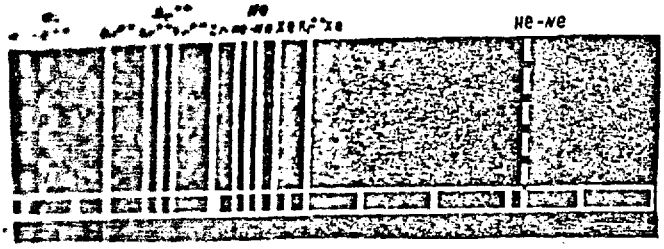
Semiconductor lasers

Up to the present time, generation has been achieved on 24 semiconductor crystals. During the bombardment of semiconductors with beams of fast electrons, electron-hole pairs are created in them. The high coefficient of amplification in semiconductors allows the creation of an optical quantum generator of a large surface area of radiation in the form of mirrors. At present, semiconductive lasers are being turned out by our industry.

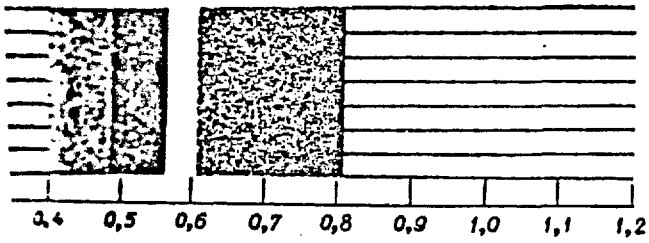
The main element of a semiconductor OQG is the semiconductor diode with a thickness of 0.1 mm and an area of a few mm^2. The plate has contacts bonded on two sides. The plate itself is made us ot two dissimilar parts, comprising an electron (N-type) and a hole (P-type) conductance. The gap difference between them is called the P-N junction. The thickness of the penetration region is somewhere around a thousandth of a mm. It is in this area that the generation of radiation also takes place. If an electrical potential is placed on the diode, then it will lead to the aggrandization of the recombination processes and the liberation of energy in the form of light quanta. Semiconductor diodes of Arsenic & Gallium (GEAs) can be generated with an impulse of high-level current and in a temperature of liquid Nitrogen. At present, generation has been obtained at room temperature as well. The efficiency of the diode is high and theoretically approaches 70%. The miniature dimensions of the lasers, the ease with which light radiation can be madulated, the different spectra of generation, will undoubtedly in the future make them into convenient apparatus for photobiological action. Our industry produces a semiconductor laser of a wavelength of 9100 Å and a power of 1 watt.

The most monochromatic light is generated by gas lasers. The generation of monochromatic polarized coherent light with the aid of gas optical quantum generators permits the selective activation of metabolical processes in plant organisms, animals and man. However, research into the specific effects of laser light during its action on biological objects did not begin suddenly. How the amassing of material on the biological action of laser radiation took place the reader will be able to discover in the following pages.





: I: spectral lines generated
er on various active mediums
, gases, solids X-axis:MKM



Спектральные линии, генерируемые лазером на различных активных средах.

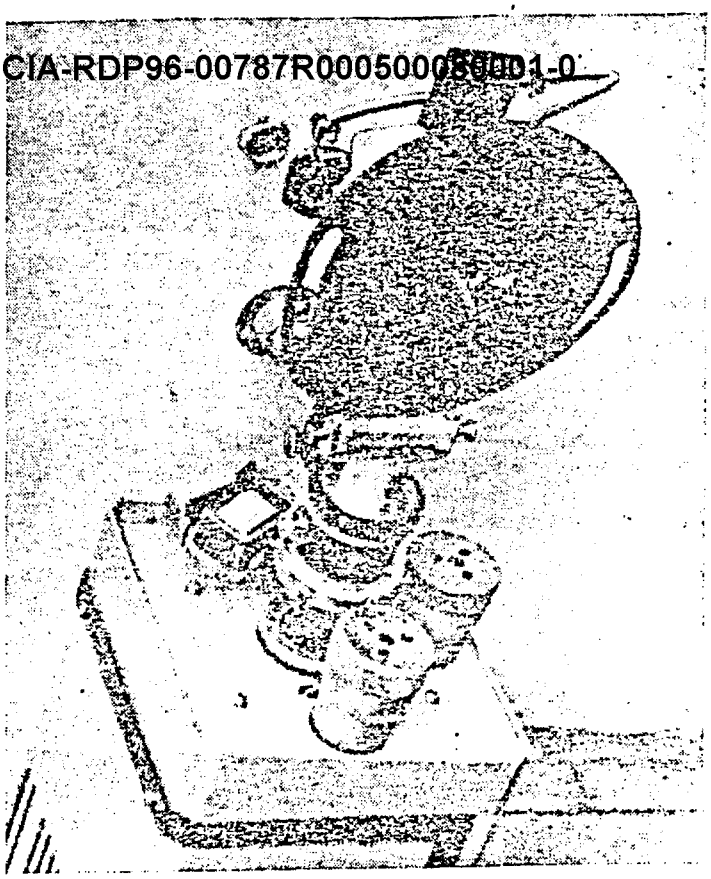


Diagram 3: External view of He-Ne laser for radiation of bone fractur and wounds.

Рис. 3. Внешний вид гелий-неонового лазера, оборудованного для облучения костных переломов и ран.

: II: diagram of an optical quantum
or "raduga"(rainbow) (1) ruby laser
esonator mirrors (2) Q-value
or of ruby (Q-switch) (3)impulse
flas.) lamps (4)ruby crystal
ndrical lens (6)nonlinear crystal doubeling the frequency of the
on of the ruby laser (7) filter absorbing the constant frequency

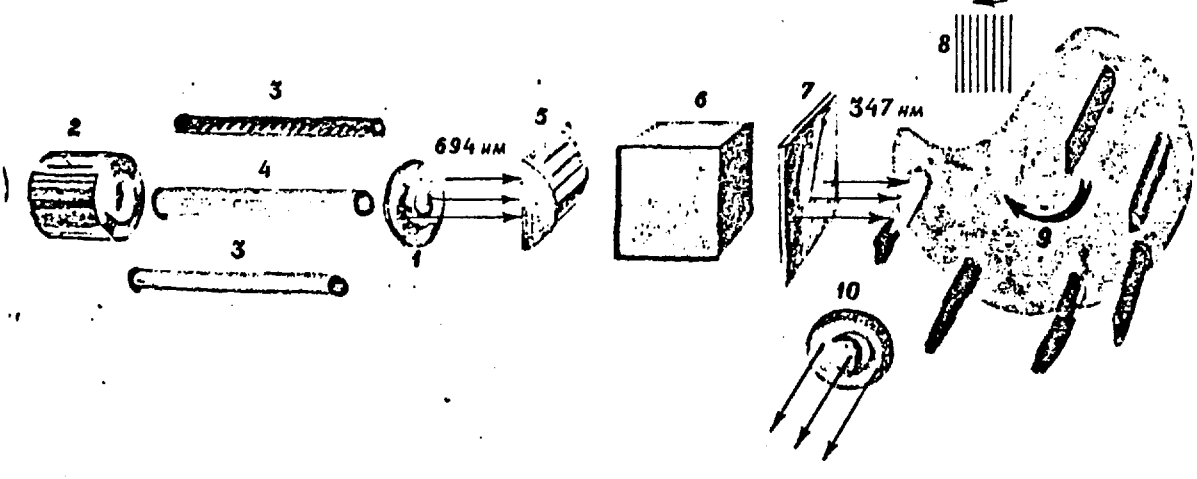


Рис. 2. Схема оптического квантового генератора «Радуга»:

кала резонатора рубинового лазера: *2* — модулятор добротности рубинового лазера: *3* — импульсные лампы накачки ного лазера; *4* — кристалл рубина: *5* — цилиндрическая линза: *6* — нелинейный кристалл, удваивающий частоту излучения ного лазера; *7* — фильтр, поглощающий неизмененную частоту; *8* — дифракционная решетка, поворот которой дает плавную ойку линии генерации в ограниченной области; *9* — револьверный барабан с 10 кюветами, заполненными растворами различных красителей; *10* — выходное зеркало лазера на красителе.

raction grating, when rotated, gives shift in generation lines within
ed range (9) revolving drum with 10 quartz tubes (cuvettes) containing
ations of various dyes (10) output mirror of the laser

CHAPTER TWO: UNSPECIFIED ACTION OF LASER RAYS ON LIVING ORGANISMS

Immediately after the creation of the first optical quantum generators (OQG) research work was done on the possibilities of using them for biological or medical purposes. As is known, lasers emit radiation at various frequencies including visible or red light. The first lasers were made for the red part of the spectrum. In this connection, the biological effects of laser radiation were most studied in the red light spectrum. As yet, little is known about other divisions of research. At the present time, ruby and He-Ne lasers are the most widely used in biology and medicine. The material presented gives an idea about which routes researchers took after new sources of light appeared, sources of high intensity. It is known that one of the characteristics of laser light is not only its high efficiency but also its characteristics of monochromatic and polarized radiation. Another characteristic of laser light is that it can be produced by short impulses, such discharges can attain large power values. As a result, the action of the powerful pulses on biological objects creates the phenomena of a locally contained thermal effect. The thermal effects of laser radiation are widely applied today in medicine. A great deal of research has been devoted to finding out the action of ruby lasers on organs of sight. Thus, lasers have found wide application as photo-coagulators for the treatment of swellings, exfoliation of the reticular membrane, and other diseases of the eye. Concomitantly, experimental work was carried on. Opthalmologists converted the high power lamp in a ophthalmo-coagulatory apparatus into a ruby laser and obtained good curative effects. A.F. Migacheva (1969) carried out experiments on more than 7o rabbits of the strain chinchilla. Radiation was effected with the aid of a ruby laser whose wavelength was 6943Å, the length of the impulse was 10^{-3} seconds. The radiation energy on horny material was o.oo2, o.o2, o.1 and 1 joule, respectively. It was observed that at this energy level of radiation at o.oo2 joules on the center of nadi, or focus of infection, the total destruction of the pigmented cells as well as the segments of the rods and cones of the retinal membrane could be seen. Layers of nerve fiber were observed. At a period of 1o days after what was happening at the nadi, there was an absence of the layer of the rods and cones and the part of the nuclei of the external necleic layer. In the remaining layers har ly any distrophic changes in the perinuclear ende and lysis of nuclei were observed. With the increase of radiation energy naturally more wide and deep damage was noted. Over a period o thirty days, the locality of damage per presented itself as being an atrophic perioretinal groove (ridge) containing chologenic fiber and pigment. In the retinal envelope, surrounding the ridge distrophal changes were observed. Data found in literature confirmed that the action of OQG rays of wavelength 6943Å, impulse length 10^{-3} sec, energy range o.o2--1 joule, creates changes in pigmentary epithelia of optical and vascular envelopes and the degree of damage is directly proportional to the amount of energy given, which penetrates the eyes. In other section of the eye around the epi-center of damage hardly any chain of distrophal changes occurs. This particularly applies to the tissues in the eye. Some researchers observed the absence of any damage to the tissue of the eye during application of OQG radiation applied with the purpose of coagulating the iris envelope. (L.A. Linnik, L.A. Vedmedenko, and others, 1969).

Those showing the recurrance of damage around the zone of coagulation are M.B. Chilik, I.K. Kerova(1969). In the same period, L.B. Butman (et al, 1969) observed possible damaging effects of laser radiation on organs of sight. In the opinion of the authors cited, the unfavorable action of laser light is increased in conditions of low illumination (ambient lighting levels) of the rooms

Such is the action of small amountsof stain combined with laser ray action. When radiation is effected through a special microscope, reports N.F. Gamaleya, a selective disintegration of the mitochondrial cells of the cardiac muscle by the impulse action of an argon laser is observed. Such selective disintegration of the mitochrondri is on account of the presence of cytochrome-C, which absorbs green light.

Many experiments have been devoted to changes taking place in the skin under the influence of laser radiation. At 3o-5o Joules energy levels, skin damage took place which manifested iteself in the form of a vesicle with an exudatory inflammatory reaction and the appearance of a rind with successive inflammations (decomposition). The majority of radiated hamsters survived. In those that died, intensive damage to their bodies was found. Usually, they were hemmorages and edema (dropsy) in the ventricular walls and in the inner organs, stomach and intestines. As far as the ventricles are concerned, situated between the damaged zone on the ventricular wall and the damaged internal organs, intestines and stomach, no visible changes whatsoever were noticed.

Histological investigations made on the damaged skin showed distinct differences between the living and non-living cells. Hair follicules retaining their pigment and those having lost them were clearly visilbe. Vesicles appeared, after the action of laser radiation and were primarily distributed in the epidermis.

Numerous investigations have been made to discover the action of ruby laser radiation on the organs of ventricular cavity, th chest, the pelvic areas, and so on.

When ruby light radiations of great intensities are applied, necrotic phenomena are observable. Thus, radiating the heads of mice at energy levels below loo Joules brought about the death of the majority of the animals, within a period of 24 hours after radiation. Bleeding from the mouth, nose, and ear channels and eye orbits was observed. Intercranial hemmorages were visible in the area of the meneglal distributions, stomachs, and conductive (circulatory) channels. No noticeable morphological changes were observable in the bone tissue. However, the marrow cells had lengthened and nuclei condensed. In this way, investigations have shown that at energies under loo joules, wavelength 6943 A, about lo% of the energy radiated e penetrates the skin, muscles and cranium. It is necessary to note that the above-mentioned results were obtained on mice, whose radiated-skin sectors were shaven clean of fur. Where fur was present, damage to the brain was less considerable.

think it is possible to limit ourselves with the factual material demonstrated showing the varous thermal and non-thermal effec of laser radiation. The above-mentioned compiled data sufficiently demonstrates the manifold biological effects brought about by laser radiation. According to the opinion of E. Klein and S. Fine, the mechanisms of laser radiation can be seen from the vantage point of two hypotheses:

The purely thermal hypothesis based on the investigation of the tissue in vitro and in vivo. According to this hypothesis, the effe ts of radiation as far as they pertain to the cell are basically not different from the effects of an ordinary thermal heating.

The hypothesis "of many factors", according to which various factors are considered to be of primary importance with the exception of increasing the temperature during radiation.

The degree of the domination of the various factors depends on the energy and intensity of the incident radiation, and is determined by the specific properties of the systems subjected to

radiation. The most important parameters of radiations are in the form of energy, energy level, power and intensity, wavelength, etc.

The physical parameters of biological systems having significance are: reflective properties, absorption properties, thermal conductivity and mechanical properties.

A.A. Gorodetskiy reports (1966) that the light of a ruby laser can bring about a free-radical state. The action of the focused laser radiation was studied by them on freshly prepared human blood samples. The samples were then subjected to staining according to the Romanovski-Gimze method. Damage to eritrocytes was discovered, the leucocytes remaining undamaged. The hemoglobin of eritrocytes is especially easily damaged (disintegrated) by the radiation impulses of a ruby laser.

During investigations made of the EPR spectrum of a whole see series of biological samples, a series of noteworthy facts were revealed. An initially shaven skin surface of animals was subjected to in vivo as well as in vitro radiation. Soon after radiation these sectors were cut off and placed in an ampule for EPR anaysis. Pigmented and white skin was analysed applying the EPR method. Un-radiated skin, white as well as pigmented, did not give out any EPR signals. In the radiated pigmented skin, EPR signals were recorded. (EPR = electron paramagnetic resonance---Eds).

An EPR signal was also observed in the eritrocytes of pigeons after their subjection to laser light radiation. Consequently, the activity of laser radiation on biological tissues leads to the appearance of free radical states connected with pigment clusters.

Investigations have also been made on human skin. The radiation of skin samples was carried out with the aid of a ruby laser. It was discovered that only the pigmented skin of a human being gives of a stable EPR signal. The nature of this signal is connected with the pigment---mellonin. One should not ignore the possibility of the participation of multi-photon processes in the biological effects of radiation. (L.B. Rubin, 1969).

In the optical waveband (visible light), one should expect a considerable intensity of multiphoton processes from organic molecules, insofar as they possess wide intensive absorbtion areas in that part of the spectrum. A definite probability exists that under the action of laser light beamed on biological objects, multi-photon processes will take place.

According to the opinion of L.B. Rubin (1969), an experimental confirmation of such processes will be of considerable significance for the following considerations: it is a well-known fact that even in the visible waveband sectors, light quanta are of extremely varied quality from the point of view of the biological effect that they produce (extremely different qualitatively). For example, red light does not show a large effect on the photosynthesising tissues, blue and violet light can bring about some suppression of life activity, ultraviolet light in the region of 2,500-2,600Å absorbed by nucleic acids brings about the death of cells. However, under the action of laser light lethal consequences can take place, both at 10,600 Å as well as 5,300 Å. As a matter of fact, the four-photon absorption of a neodymium laser radiation, 10,600 Å or a two-photon absorption of its second harmonic, 5,300 Å will be equal to the action of 1 quantum of wavelength 2,650 Å. Consequently, in experiments and evaluations of data obtained, it is neccessary to take into consideration the possibility of the existence of multiphoton processes.

At present, intensite research is being made into the reaction of irradiated cells to [illegible]

After radiation of Hela cells with the aid of a ruby laser, change in the chromosomes of their tissue structure were noticed, which were morphologically convergent with the changes in the nucleus after X-ray radiation. (S. Fine and E. Klein 1968) The process of cell division arrested in the prophase of human leucocyte cultures subjected to ruby laser radiation, are described. After chicken embryos were subjected to impulse ruby laser radiation, abnormal phenomenon were observed through the shell. The extremities of the embryos became deformed, and a lumpiness was observed in the internal organs.

There have been reports of the possibility of damaging inner cell organelles in the culture of the myocardic tissue, with the aid of microwave argon laser. Therewith, a collective destruction of mitochondria in living cells of the tissue culture can be observe On going through the experimental data concerning the action of neodymium and ruby lasers on tissue culture cells, the majorit of authors come to the conslusion that most rapid damage develops in the membrane structures of mitochondria- the endoplasmatic reticule (N.F. Gamaleya, 1972).

Apart from that, the suppressive action of Helium-Neon laser light is observed in the multiplication of living cells in a tissue culture.

Recently, works have been published concerning the possibility of obtaining chromosome aberrations under the action of uninterrupte laser radiation of various wavelengths. He-Ne lasers 6328 Å, power 12 milliwatts; argon lasers 4880 Å, power 135 mW; nitrogen lasers, 5682 Å, power 1 W, carbon-dioxide of 10,600 Å, power 1 Watt, were us to bring out these effects. Onion roots of the baton type were sub- jected to radiation. At the same time, a marked increase of aberrat

output was observed during radiation by spectral lines in the visibl band. It was discovered that the percentage of the chromosome aberration output is dependent upon the dosage. At wavelength 4880 saturation was observed. With a further increase of dosage, no increase in abeeration output was established. For a wavelength of 5862 Å, the curve was of a resonant character with the maximum output of chromosome aberrations at 3.4 joules/ cm^2.

As is apparent from the material of our review, the majority of work has been devoted to biological research into the action of longwave monochromatic red light of a ruby laser of high intensity. In their work, investigators have drawn attention to research into changes taking place in fermentations, tissues, etc. occuring durin high-power radiations, when the domonant factor is the thermal effect. At the same time, hardly any isolated experimental facts a known about gas laser radiations of comparatively low power, but high degree of coherence and polarization, possessing non-thermal specific effects. At the same time, such experimental findings wer not explained, they were not used as departure points for systemat research. Let us now consider a few of them in greater detail.

E. Karlander and R. Kraus (1968) did some interesting experimental work aimed at explaining the physiological effectivene of light obtained from both coherent and noncoherent sources.

A non-coherent source of light equivalent in energy and wave- length was a monochromator. One of the indexes of photosynthesis intensity of chlorella (a plant, which grows in water in closed-typ ecological systems---Eds) served as an indication of the degree of hydrogenation. The data obtained by the authors is contained in Table 11.

The authors suggest that coherent light is photosynthetically more active than non-coherent light of the same wavelength. Laser light is 2o-3o % more effective than that of a white light lamp or monochromater. O.P. Sachkov (1969) also observed a sharp increase in the production of hydrogen blue-greenwater plants when they were subjected to supplementary He-Ne laser light.

Of great interest is the work that has been done by A.I. Semenova and V.A. Singayevskiy (1969) explaining the biological action of low-intensity laser radiation on the living organism (animass). A.I. Semenov carried out experiments on 68 white rats. Research was made into the hromonal reaction on the suprarenal. Radiation activity was effected with the aid of He-Ne, ruby, and Nd++ lasers. The experiments conducted showed that the action of He-Ne laser radiation of constant activity (i.e. continuous wave, or CW---Eds) over a period of 1o-2o minutes brings about hormonal reactions in the suprarenal regions manifesting themselves with the decrease in the number of iozynophyles int the peripheral blood by 3o-7o %, the increase of the suprarenal weight by 2o-4o %, and the decrase in the content of lipoids in the suprarenal cortex. These changes obtain their maximum value 15-2o minutes after radiation was initiated, and 2-3 hours after radiation, the hormonal reaction decreased to its initial level.

The return to the initial level took more than 5 or 6 hours in rats with a weak nervous system. A similar hormanal reaction was hardly noticeable after many radiations with impulse lasers. Apart from the hormonal reaction a sharp increase in the demand for hydrogen of 5o-1oo% was observed. A.I. Semenov shows that a single gas laser radiation is equivalent to many repeated radiations carried out with the aid of an OQG of the ruby and Nd++ type.

Furthermore, A.I. Semenov and V.A. Sengayveskiy have discovered that by radiating the eyes of animals with even low-intensity gas laser radiations, wavelength 6328 A, brings about considerable functional changes in the cardiovascular system. Changes in the tone of the vesseis have been established. After adaptation to darkness, the radiation brings about a marked displacement in arterial pressure (on the average 2o-3o mm Hg st.). Arterial pressure has a tendency to decrease. Sharp changes in the activity of hollyesterases take place in the direction of its increase after the eyes of a rabbit have been subjected to He-Ne radiation. A displacement of Ca-Na (Calcium-Sodium) balance in the reticular tissue of the eye has been noted. According to the authors, all these effects can bring about changes in the parasympathetic sector of the nervous system, that is, they are of a vagotropic character.

Consequently, as the various experimental work shows, living organisms are able to react specifically to the action of laser radiation of different wavelengths and intensity.

The above-mentioned bibliographical data demonstrates the gradual evolution of the opinions of the researchers concerning the mechanisms of laser light action and the greater interest shown to the problems of the photobiological non-thermal effects of this new form of radiation.

To show the perspective of this development in the utilization and discovery of the physiological effects of laser radiation one can go back as far as 1965 when it was possible to get acquainted with the effects of increased biological activity with the aid of monochromatic red light, linearly polarized (V.M. Inyushin, 1965).

Since then, 9 years have elapsed. As result of intensive work, considerable material concerning the biological activity of monochromatic polarized noncoherent radiation and gas laser radiation has been amassed. The results of these investigations are presented in

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CHAPTER 14I: PHYSIOLOGICAL ACTION OF MONOCHROMATIC-POLARIZED RED LIGHT ON PERIPHERAL BLOOD AND BLOOD-FORMING ORGANS

The first experiments concerning the discovery of the action of laser rays or other light wave apparatus radiating monochromatic polarized red light on the composition of peripheral blood and blood-forming were carried out in Alma-Ata at the faculty of biology of the Kazakh state University.

Such research was neccessary for the evaluation of the specific reactiveness of the blood-forming organs subjected to light radiation of definite quantum-and-wave parameters. They were to open the way for the wide use of laser radiation in the clinic.

During the total radiation of white rats and cats over periods of a few minutes with noncoherent light of maximum 6300-6400 Å over a period of 10 days, we observed rises in the content of eritocytes and leucocytes (V.M. Inyushin, 1965, 1967). On the 5th day after radiation the content of hemoglobin increased to more than 12 units. The number of eritrocytes decreased somewhat over the day after the initiation of the radiation, and as the time went on progressively increased from 6 million to 8-9 million, towards the 10th day of the experiment.

Similar reactions were observed in dogs which were subjected to noncoherent-polarized-monochromatic red light radiation of the very same intensity.

All our experiments were carried out as part of a plan to make a comparative evaluation of noncoherent and to a lesser degree, monochromatic red light obtained from gas discharge sources and laser radiation. Making use of flouresence microscopic studies of blood smears, we came to the conclusion that under the action of gas laser radiation wavelength 6328 Å radiation intensity 2 mW/cm^2 (without any noticable thermal effect) already a day after a double total radiation of white rats, there was a rapid increase in the amount of young forms of red blood corpuscles--reticular sites.

In connection with this and in order to make an accurate evaluatio of bone marrow production or eritrocytes under the action of stimulants it is not enough to take only the number of eritrocytes and reticulra-cytes into consideration, in our laboratory more detailed experiments were carried out. The average maturation time of reticular sites was determined according to methods submitted by N.E. Mosyagina (1962).

A series of experiments were carried out which demonstrated that [illegible] increase of eritrocytes took place on an average by a factor of

1.5-2 times, already the 3rd day after the 2 min procedures of monochromatic polarized red light activity obtained from a noncoherent source with its maximum in the range of 6400 Å and a gas laser wavelength 632 Å. In addition, the laser radiation brings about quite a steep increase of eritropoetic production. But, the epitropoesis curve of differentiation has a more wave form character in terms of time then in the case of the action of monochromatic red light issuing from a noncoherent source. The increased production of eritrocytes was observed in the case of the activity of total laser radiation. The increased production of eritrocytes in comparison with the norm was observed also on the 17th day after commencement of radiation.

Consequently, the effect of monochromatic coherent polarized light manifests itself as being physiologically a more resonant character than the noncoherent, and its effect perpetuates over longer periods of time after the initial effects. However, the noncoherent source of polarized red light (the apparatus for thermal light radiation patent nr. 245995) also demonstrates a noticeable effect on the blood-forming organs.

The condition of the marrow during the radiation of living creatures indicates that this ray factor acts as a stimulator. It was also noticed that after a single 2 min radiation with the aid of noncoherent monochromatic polarized red light that the number of vasophilic and polychrome eritroblasts increases on the average by 5-10

When repetitive radiations were carried out over a period of 4 days, an increase of young eritroblasts was observed (bazophil polychrome and normoblasts). The number of mielocytes increased, especially the eozinophile by a factor of 3-4 compared to normal conditions. There was an increase in the activity of mitotic activity, of the bone marrow cells.

Also, considerable changes were noticeable in the milt (spleen). In the initial stages, a filling up of the spleen with hemolorized blood took place, and with further radiation by monochromatic polarized red light there was an increase in the number of young lymphocytes, which demonstrated the existence of the activation of lymphopoesis. (V.M. Inyushin, 1965, E.P. Smirnov 1967).

To evaluate the reaction response of the spleen we applied the technique of biotic staining introduced and discovered in their time by D.N. Nasenov and V.Y. Alexandrov (1940). The numerical evaluation of the sorbic stain (neutral red) was carried out with the aid of photoelectro-colorimeter. The data show that the maximum changed of sorbical properties is observed from the 3rd to the 6th day after the commencement of the 2 minute action of monochromatic polarized red light. The increase of sorbtion compared to the control group (of animals) comprised from 30-40%. During the total radiation by gas laser light of wavelength 6328 Å of adequate duration and intensity, a sharp increase of sorbtion already after the first one or two hours was observed after radiation. The excess or sorbtion indicators (indices) can sometimes be from 1.5-2 times greater than the norm. At the same time, the consequent drop in the amount of sorbtion staining takes place more rapidly than in the case of radiation by noncoherent, monochromatic polarized red light (the data of N.G. Tkachenko.).

The results obtained demonstrate that during radiation the effectiveness of response is determined by the influence of the degree of monochromaticity and as far as is possible the coherence of radiation. During the action of laser light, the response of the spleen is more distinctly expressed. It is interesting to comment that an idiosyncratic accumulation of activity takes place in every case within the first three days. During the action of laser light,

trained directly on the isolated spleen, we also observed an increase in the sorbtion of the neutral red. Consequently, it is possible to have a direct influence of light on the organ.

The above data demonstrate the real effect of the action of monochromatic polarized red light, extracted from the shortwave section of the red spectrum on the production of blood. Similar effects are obtained with the aid of laser light. In both cases, no irreversible pathological changes of any sort were observed.

In recent times the reaction of blood forming organs were studied for the most part in connection with the activity of ionizing radiatio and sometimes ultraviolet light, electromagnetic vibrations of an ultra- high and extremely high frequency. The material per present in this section demonstrates that visible light, especially red light, exerts a stimulating influence on the composition of peripheral blood and blood-forming organs.

Blood-forming reactions in the organisms of living beings subjected to long-term action of laser light were studied. In such experiments we observed a periodic inhibitive effect on blood forming which was of a reverse character.

In our opinion, the activity of MRL on blood-forming organs and blood generated by a laser or other light sources takes place both directly and indirectly.

In the first case, the red light absorbed by the porphirines can bring about the lessening of the resistance of the older eritrocytes and their disintegration (photodynamic effect). This process can be intensified by adding photosensibilitizers into the blood. The products of disintegration can be activated by the blood forming process of the marrow.

It is known that native blood (A. Chizhevskiy 1973) circulating in the vessesl comprises an ordered system. In our laboratory, I.B. Beklemischev carried out a series of experiments. It was shown that blood comprises a system with labile phases and a high degree of cooperativeness. The effects of laser radiation can be realized theough the blood thanks to which an accumulation and migration of absorbed energy is obtained. During the direct action of OQG radiation on blood exposed many times, a decrease in the number of absorbed methyline blue was observed. At the same time, the character of the sorbtion changes---their rise or fall---were dependent on the initial indicators. At low initial indications, radiation as a rule showed their rise, at high indicators, their fall.

They suggest that blood is a liquid crystal substance in which light induces multifarious energy processes. Consequently, it is possible to assume that the fact that the action of laser light on blood is of a direct nature has been proved. Blood is a substance through which the transfer of absorbed energy to the various points of the organism takes place. At the same time, the indirect activity of MPRL on the forming of blood takes place on account of the activation of the functioning of the endocrinal tissues (glands), above all, the hypophysic (pituitary---Eds) and thyroid which have a direct relationship in regulating functions of blood forming.

CHAPTER IV : THE REACTION OF ENDOCRINAL GLANDS DURING RADIATION BY MONOCHROMATIC RED LIGHT

The ability of endocrinal glands to react to visible light is common knowledge. It has been shown experimentally that under the influence of visible light, functional and morphological changes which lead to intensified secretion of the gonadotropic hormones in the blood takes place at the front bottom of the hypophysis. Apart from that, it is known that the hormones of the front bottom of the hypophisis not only control the gonadotropic action but also influence glands of internal secretion. The function of the thyroid gland is directly dependent on the intensity of secretion of the tireotrophic hormone of the hypophisis. A.A. Voytkevich (1945) experimentally demonstrated that the tireotrophic function of hypophises in frogs and toads is activated by the visible light from an incandescent lamp. There are indications that the hormonal activity of hypophises is stimulated by red light (N.A. Popov 1940, A. Emme 1958, et al).

Not much has been discovered about the biological effects of separate monochromatic sectors of visible light. M.E. Zeltser has made research into the condition of the thyroid glands of white rats after they had been subjected to a single total dose of monochromatic red light radiation wavelength 6400 A over a period of 2 and 5 minutes. Already 15 minutes after the introduction of the isotope, the amount of radioactive iodine in the radiated rats was considerably higher than the control group.

The maximum iodine absorption is observed 2-6 hours after introduction of the isotope. In that period, the difference between the control and experimental groups reached maximum amounts, and and was statistically significant. One day after the 2 min radiation the condition of the thyroid glands normalized. According to the author, the results obtained demonstrated the activization of the thyroid gland after a single dose of monochromatic red light radiation. L.S. Prihod'ko and M.E. Zeltser (1967) report of results obtained on the reaction of suprarena to multiple radiations of white rays (MPRL) of identical wavelength in experiments to discover the functional activity of thyroid glands. A decrease in content of ascorbic acid was observed which points to the hypofunction of the superrena. After the single doses of radiation no noticible increases in abscorbic acid content were observed.

We reached slightly different conclusions while examining the histophysiology of the superrena. An analysis of the substantive changes in the superrena subjected to monochromatic polarized red light and gas laser light enabled us to discover a complicated physiological reaction of this organ. After a single 2 min monochromat red light dose of radiation, the stain sorbtion usually decreased which might point to a decrease in function. Towards the 3rd day after the initiation of double doses of radiation the suprarenal sorbtion increased about 50%, and towards the 6th day, begins to approach the normal level. Laser light brings about a more rapid increase in sorbtion which is already observable 30 min after a single dose of radiation. Furthermore, a sorbtion increase takes place reaching an almost 2-fold value with a successive decrease towards the 6th day and 10th day of action.

(Notes: Mitoticic: temporal structure in a dividing cell creating the movement of chromosomes towards its poles which insures their equal distribution between the daughter cells.
erithrocyte: red blood corpuscle. eritroblast: cell of bone marrow, precursor of red blood corpuscle. Nucleated, undergoes mitosis, gradually develops hemoglobin.---Eds)

Consequently, such an important gland of internal secretion as the superrenal happens to be subjected to more marked changes in function under the influence of coherent monochromatic light, 6328 Å, in comparison with a less monochromatic, noncoherent radiation with its maximum at about 6400 Å.

The stimulation of the superrena is indicated by biochemical data as well as results obtained during histological and histochemical research. The data prompted the thought that laser light is utilizible as an anti-inflammatory treatment. At the present time, our hypothesis has obtained the support inclinics dealing with a whole series of ailments.

Together with doctor O.A. Zavyalov at the ministry of health clinical hospital of the Kazakh SSR, we observed 70 patients suffering from rheumatoid and transformational distrophic polyarthritis. Of these, 39 suffered from rheumatoid polyarthritis, and 31 from transformation distrophic polyarthritis. Among those suffering from rheumatoid polyarthritis, there was a preponderence of women, ages 35-65 years, the majority, 30, having suffered for more than 5 years. They had many times received treatment in clinics and health resorts without any noticiable therapeutic effect.

At reception, the sufferers were subjected to a whole complex of clinical, biochemical, and X-ray examinations, confirming the diagnosis. According to the degree of activity (according to Nesterov) and the process phases, the sufferers were calssified as follows: activity of first degree (in 15), activity of 2nd and third degree (in 24), acute exudative phase, in 1 patient, sub-acute exudative proliferative, in 33 and fibrose-sclerotic in 5 patients.

The sufferers received treatment from a monochromatic red light source radiated from a prototype He-Ne laser, LG-75, wavelength 6328 Å. Concurrently, 5 patients were given massage and physiotherapeutic exercises.

The radiation was of the general local character of activity on the damaged joints and reflexo-genic zones, applied in physiotherapy. Radiation exposure varied from 1 to 30 seconds on each area, and was selected according to the initial condition of the patient, the phases and degree of process activity.

Some patients experience a slight vertigo, sleepiness, and increased perspiration after the first 2 or 3 sessions. After adaptatio to radiation, these symptoms disappeared. After 3-4 sessions, a photoreaction was observed in all of them. In this period, an increase in pain in joints was observed (in all the patients) the appearance of swelling joints, (in 3 patients), the increase in temperature (5 patients). In one patient, a slight increase in arterial pressure was registered. In this period, radiation was prolonged, but with decreased exposure. In 2-3 days, all the effects dampened down. Towards the end, the pain syndrome decreased in 35 patients, the exudative phenomena died down, the area of joint movement increased, Morning stiffness was less marked.

No marked changes were noted in the hemogram. The ROE became slightly more rapid towards the middle of the course, returning to its original value towards the end of therapy. Towards the middle of the course, some decrease in lymphocytes took place, levelling out towards its end. The S- reactive of white corpuscles did not change during therapy. The fibroginogen increased towards the 10th session, and decreased towards the 20th, remaining within the norm. The contnet of albumin increased somewhat in the middle of therapy, and towards the 20th session decreased to its initial level. Towards the end of therapy, and hypergamm globulins and gamma-globulins were observed.

Out of 39 patients, improvements were observed in 35. The polyarthritis and multiple-ancilosis-(bending ability of a joint to move as a result of the growth in joint swellings---Eds) and in 1 patient with exudative proliferative phase process, who violated the regimen. We did not observe any worsening of conditions of negative changes in the joints of a single patient.

Milder, delayed results were traced in 21 patients. Of them, 19 with exudative proliferative changes, a decrease in joint paind was achieved, an increase in their mobility, a decrease in morning stiffness, compared with the initial condition. In these patients, a good therapeutic effect was obtained after the second session of treatment. Af first, no improvements were observed in 2 patients, with fibro-sclerotic process phases.

The dynamics of the amount of leucocytes and ROE in the second course of treatment did not change. A tendency for the number of lymphocytes to increase towards the 2oth day of the procedures was observed. Apart from that, a decrease in the content of general white albumin and alpha-globulins was observed. The S-reactive of white corpuslces did not change.

In the group of transformational distrophic polyarthritis patients were 17 women and 14 men, aged between 35--65 years with a case history of more than 3 years. Of them 21 with nerve osteo-arthrisis primary and lo with distrophic damage to joints of different orgin: changing, hormonal, professional, and others. Treatment of those patients was the same as those suffering from rheumatoid polyarthritis. In this group, an analagous phtotreaction was observed. However, the pain syndrome decreased more rapidly than in those suffering from rheumatoid polyarthri6tis. Also, towards the end of the course, mobility was increased (area of movement). There were improvements of greater or lesser degree in all patients. Hematologica data reflect the tendency of the ROE to decrease. The number of leucocytes increased somewhat towards the middle of the course, thereafter decreasing to initial values. The number of lymphocytes increased within normal bounds.

A.M. Moshcheyeva of the ministry of health Kazakh SSR clinical hospital investigated some biochemical indices of blood during laser radiation stimulation in 62 patients, suffering from inflammatory processes of the uteral appendages. The dynamics of the white corpuscle fractions of the blood serum was determined with the use of A.E. Gurwich's method. The electrophoresis was carried out in a buffer medinal -verinal solution of Ph 8.6 with a tension (potential) of 3oo V. The data obtained was quantatively deciphered on an FEKM (photo-electron microscope ?--Eds). Concomitantly, the quantity of general serum white was determined by the biuretic method, modified by L.I. Slutskiy (1964) on a spectrophotometer SF-4A. (Note: a biuret reaction is a chemical test used for proteins in solution. Employs copper sulphate in akaline solution, which gives purple color with proteins and with a few other substances---Eds).

The first group of 31 subjects comprised patients with an acute form of chronic inflammatory processes taking place in the uteral appendages. The second group were patients with inflammatory processes in the chronic state of illness, 31 subjects.

In the control group of healthy women, the mean level of general white content was in the region of 7.9o ± o.77 g % which corresponded to data found in the literature. In the first group, the content of general white serum of the blood in 28 patients was within normal bounds and in [illegible] (6.15 9-6.o g%).

The concentration of serum white corpuscles on the average comprised 7.69 ± o.o96 g % which was somewhat below the indices of the control group. If the indices of the general white corpuscles of blood serum did not show simular rises, then the separate white corpuscle fraction showed marked changes. White corpuscles were observed in only five patients, while, in 26 of them , a decrease was established. If the mean index of albumin content in the men of the control group comprised 4.68 + o.o42 g %, then in the group with acute chronic inflammatory processes it was considerably lower: 3.98 ± o.98 g % at P less than o.1 .

With the analysis of globulin indices of serum blood fractions a considerable increase in the content of alpha-2 and gamma-globulins and less pronounced increases in alpha-1 and beta-globulins was established. With the determination of the albuno-globulin indatator coefficient, its decrease was discovered in comparison with the norm, which points to the sharpening (worsening) of the inflammatory processes

Under the influence of laser radiation therapy, tog ether with a clinical improvement genuine changes in the content of the various albumin fractions were observed, which pointed to the cuperation of the inflammatory processes.

Thus, towards the loth procedure, especially towards the end of treatment, a consistent increase in albumin content was observed, the decrease in all globulin fractions, especially the alpha-2 and gamma fractions. The albumin-globin coefficient index attained a characteristic value for healthy women, in practical terms, 1.34 ± o.o41

As was expected, the inflammatory process in the chronic stage of illness presented a different picture. In 2o patients of that group, the index of general albumin was somewhat higher than the mean index of the control group, and only 1 patient manifested an insignifica hypoproteinia (6.o g %). If during aggravation of the inflammatory process, a decrease of the albumino-globulin coefficient was noticed, then in the inflammatory process of the chronic state of illness it was within the normal bounds, 1.56 ± o.o47. Towards the loth procedure, parallel with the clinical manifestation of the aggravation of the inflammatory process, a certain decrease in albumin content was observed, the increase of all globulin fractions, and corresponding decrease in the albumin-globulin coefficient (1.27 ± o.o48). Towards the end of traatment, a normalization of the albumin content of blood serum manifested itself. Albumins returned more rapidly to normal and alpha-2 and gamma globulins more slowly. A tendency towards the normalizations of the albumin coefficient (1.34 ± o.o48) was observed.

In this way, research made into the albumin fractions of blood serum in the various stages of inflammatory processes of uteral appendages as well as the influence of laser radiation therapy enabled the statement of the following principles:

1) The serum protein changes taking place during inflammatory processes in the uteral appendages reflect the acuteness and severity of the disease process. The more severe the process, the lower the quantity of general albumin, the lower the albumin--globulin index the higher the content of globulin.

2) Patients with an acute form of chronic inflammatory processes of uteral appendages subjected to laser ray therapy parallel with clinical recovery, were observed to reach a state of normalization in their albumin content, general albumin, albumin-globulin coefficient, and decrease in globulins, especially alpha-2 and beta fractions.

3) Towards the loth procedure of therapy interferences in the blood albumin spectrum were observed in the inflammatory process of chronic

earlier rises in albumin fraction contents were observed.

Y.E. Bihovskiy of the ministry of health Kazakh SSR clinical hospital carried out He-Ne laser therapy on 68 ill women, among them 3o suffering from acute form of chronic inflammatory processes in the uteral appendages and 38 from a chronic stage of inflammation. 44 women suffered from a two-sided inflammatory process, and 24 from a 1-sided (i.e. bilateral and unilateral---Eds). Their ages varied from 2o-43 years.

The duraction of illness varied from 5 months to 17 years. The cause of illness in 4o women were the results of abortions, in 9, the result of pathological factors, in 12, the provoking factor was chills, in 7, causes could not be determined. Prior to entering the clinic, they complained of general deficiencées, lack of sleep and appetite, irritibility, perspiration , constant or periodic pains in the lower sectors of the stomach, and loins, with irridations of pain into the lower limbs, painful, abundant irregular menstrations, and paleness.

3o patients manifested a sub-fibril (i.e. below fever---Eds) body temperature. 32 women suffered sterility.

All the patients were subjectdd to clinical and sometimes laboratory tests during the therapy process. Laser ray therapy was carried out according to a method worked out by us. Laser light radiation was carried out on a specially constructed He-Ne laser LG-75, wavelength 6328 Å, intensity 25 mW/cm^2.

The length of radiation on definite reflexogenic zones and known acupunctural points varied according to the reaction of the organism to the therapy applied.

The total single radiation exposure lasted from lo-15 minutes. The course of therapy from 2o-25 procedures, which were carried out daily at exactly the same time.

The patients did not receive medicaments either before or after subjection to radiation. In 3o women, after the fourth to loth procedures, the acute stage of chronic inflammatory processes of the uteral appendages showed an improvement in general condition; a decreas in pain below the stomach and loins, normalization in body temperature. During this time, a numberical increase in the index of the sial acid was observed. Although statistically it turned out to be insignificant. Analagous results were also obtained by us in the indices of S-reactive albumin content. Towards the end of therapy, together with the significant clinical effect, a genuine dec rease in the index of the sial acid was observed in the 25 pati which pointed to the cuperation of the inflammatory process. As far as the S-reactive albumin index is concerned, we did not discover any divergences of its content practically speaking, in any of the healthy women.

Thus, after the termination of the first course of therapy of patients suffering from acute chronic inflammatory processes in the uteral appendages, a total therapeutic effect was attained by 17, a partial effect by 8, with no effect noted in 5 women. 13 patients who did not obtain the full therapeitic effect were recommended to take a repeated course of laser therapy stretching from lo-15 sittings 2-3 months after the first course. After the second course ended, lo out of the 13 patients attained a full clinical effect, which was confirmed by the data obtained on the sial acid and the S-reactive albumin. The effect was absent in 3 patients who were later found to have a piosalpincs in whose cases operative therapy was neccessary. (Note: from the Greek :pion, and salpincs---tube, i.e. "rotting tube" or a limited collection of rot in the uteral tube, which leads to peronitis if not treated

Out of 38 patients in the chronic stage of illness, towards the loth procedure, 22 were observed to undergo a worsening of general condition, and intensification of pain below the stomach and loins, an increase in albumin, lack of sleep and appetite, in 8 patients, a sub-feverish body temperature appeared.

All this pointed to the intensification of the inflammatory process of the uteral appendages. After the first course of treatment 27 out of the 38 women noticed a disappearance of the inflammatory state and pains in the regions of the uteral appendages. The latter were movable at palpation. 7 patients obtained a partial effect, a certain decrease in the dimension of inflammatory formationf of uteral appendage and a decrease in pain at palpation. No effect was noticed on 4 patient: When analysing the indices of sfal acid in the process of therapy, a noticable increase towards the loth procedure was established. In in some patients, it lasted until the end of the first course of therapy. (From o.197 ± o.09 to o.214 ± o.016), P less than o.ool) which pointedto the aggravation of the inflammatory process. Towards the middle of therapy, the S-reactive albumin indicator had a tendency to increase somewhat, however, statistically, it turned out to be insignificant. 11 Women in the group which did not obtain a full effect underwent a repeated course of laser radiation with good results.

Investigations made into the dynamic changes of hemograms in the process of laser light therapy, showed that in the process of treatment, the red blood diagram did not change in either of the patient groups. No significant increases in the quantity of leucocyte contnet was established. The reactive index of eritrocytes sedimentation (ROE) varied somewhat during the process of treatment, however, these changes were within the bounds of physiological norms.

When dealing with the white blood diagram, it is neccessary to observe that towards the end of treatment, the quantity of neutrophyles definitely decreased in patients with chronic inflammatory processes in their acute states.

In the majority of patients of both groups, together with their clinical recovery, a certain increase in eozynophyles was observed. (Note: eosinophil leucocyte: polymorphonuclear leucocyte of vertebrates, containing granules staining in acid dyes such as eosin. In human beings normally about 2-5 % of all leucocytes but become much increased in certain parasitic infections, and in allergies---Eds).

The changes taking place corresponded to the clinical recovery of the patients. We investigated the long-term results of laser radiatic therapy in 53 patients over a period of 5-12 months.

Over the period mentioned no symtoms whatsoever were observed in any of the women, pointing to the existence of an inflammator process which is confirmed by clinical investigations of data. 7 women who earlier suffered from sterility, became pregnant.

Chapter V . Stimulation of regeneration by monochromatic red light.

By the local action of polarized MPRL (monochromatic polarized red light) wavelength from 6300-6400 Å on skin wounds (lesions) distributed on the ear of a rabbit, a characteristic histologic change was observed which pointed to the stimulation of regenerative processes. This was done by B.L.Koritniy and collaborators in 1967. Although the experiments were carried out on the same rabbit, one ear being radiated by monochromatic polarixed light and the other serving purposes of control, distinct morphological changes manifested themselves under the action of red light. And so, in the wound which was subjected to radiation, already within a period of three hours, a larger number of neutrophyles began to appear than in the control ear. In successive periods, an increase in the intensity of phagocytis was noted. The bacterial flora compesed of diplo and tetra-cocci almost entirely phagocytosized in the wound exudate. A more rapid healing of wounds was registered when monochromatic polarized red light radiation was applied. At the basis of the observed effect, according to the authors, lies the activation of the transformation of properties in the skin during the local activity of polarized red light.

A large cycle of work was carried out by prof. D.L.Koritniy, explaining some of the morphological and histological displacements in the auto-transplantation of the skin of a rabbit during the action of monochromatic red light. It is curious that during macroscpic observations, a very distinct difference in the condition of transplanted skin (shreds) is engendered with hardly noticeable chitterlings (tripe, intenstines). During histological trials characteristic hanges manifested themselves already in the course of the first days after radiation was initiated. The leucoctytal wall in the radiated skin shreds was considerably more prominent in comparison with those that were not radiated. During the activity of monochromatic polarized red light an accelaration of inflammatory process-phase changes occur, and the proliferation of fibroblastic elements is stimulated. Characteristic is the absence of fibrose nourishments (nutrients) which in unradiated auto-transplants appear as whole separate areas.

At the same time, on the background of the stimulation of connective tissue elements, the re-epidermation of the radiated transplant slows down. Only towards the twentieth day does the whole transplant again become covered by the epidermis created. In radiated transplants [illegible] elements of the epithelia along the connective tissue slows down, [illegible] in comparison with the control samples, for example by ten days. However, in the restituted phase a new epithelial covering of the [illegible] transplant manifests a quickening tempo of its productivity. After a period of one month after the transplantation the organo-specific structure of the radiated transplant [illegible] reestablishes itself to the same degree as transplants not subjected to the activity of monochromatic polarized red light do in a period of 2-3 months. During the analysis of glycogenes in the epidermis, it has been observed that under the influence of monochromatic polarized red light after a period of ten days (10x24 hrs.) an increase in concentration occurs. After this, a decrease of glycogene concentration in the epidermis of skin shreds takes place, when compared with control samples, which is explicible by the more greatly accelerated tempos of epidermis differentiation.

The dynamics of RNK change reflects the entire regenerative process during the presence of auto-transplantation. In the first 10 days of regeneration, the concentration of RNK in the radiated sample

exceeds this in the control sample, in this case, twofold.
ccording to D.L.Koritniy, the RNK concentration in the epithelia of the radiated transplants is relatively lower on the 2oth day and is even ower on the 3oth day after transplantation, this being explained y the increase of the morphological processes in the epithelial plast. It follows that monochromatic polarized red light turns out to be a powerful stimulator of regenerative processes in wounds as well as in freely transplanted skin.

The next experiments were carried out using coherent red light. In the republic clinical hospital of the ministry of health of the Kazakh soviet socialist republic in the biophysical laboratory of the Kazakh university and in other medical-biological establishments a considerable amount of factual material has been collected demonstating the possibility of utilizing the biostimulation of physiological processes with the aid of monochromatic light radiations from He-Ne lasers. Some therapeutical aspects of the effectiveness of such biostimulation were learned.

Below, we reveal our experience during experimental work concerned with the stimulation of regenerating processes by the radiation of He-Ne lasers and our clinical work when we used low-power lasers for the treatment of some ailments.

The rapidity of the process of regeneration, its stimulation, or inhibition is a good indicator of the activity of chemical or physical agents.

Assuming that the endogenal ray regimen of mitogenetic radiation during regenerative processes manifests itself as one of the conditions determining the proliferation of cells, we carried out a series of expeiments to explain the possibility of stimulating regenerations by laser light on account of the induction of secondary radiation in the UV waveband. The possible aspects of applying low-intensity He-Ne laser light for the regeneration of bone tissue were learned. The experiments were carried out by P.P.Chekyrov on 72 mongrels. The regeneration was studied on the radius bone when it was sawn (partal cleavage) and total cross-section fracture. According to bibliographical data during the trauma of the radius bone, its regeneration takes place according to the first mentioned type. At total cross section fraction of the radius bone the second type of regeneration predominates, with the appearance of bone overgrowth (bones becomes thicker). The operations Were carried out according to strictly standard methods in aseptical conditions under general narcosis. The depth of the surface sawing was measured with the aid of dividers. The wound was sewn up hermetically after which an antiseptic bandage was placed. To attain the total fracture of the radius bone, an electrical cutter was used, the cut made was equel to 4/5 ths of the bone diameter, after which it was broken with the aid of mechanical force. The remaining operations were the same as in the first case.

On the plaster of paris binding, at the site of the fracture an opening 1 cm sq in diameter, was made, to facilitate radiation by laser light. The locality of the fracture was radiated with coherent monochromatic light of the optical quantum generator wavelength 6328 Å of intensity 1o mW/cm^2 (Diagram 3 - caption: external view of He-Ne laser for the purpose of radiation bone fractures and wounds). Radiation was carried out in conditions of darkness, without additiona illumination. Exposures varied from 1-1o m nutes. Observations were made in peiods of 5o-9o days after the trauma was made. In those periods, all dogs underwent roentenography of the radius bone, comparing the roentgenograms obtained with the control samples made during the same period of observation, the following was observed

On the X-ray of the control dog, the saw cutting was still observed at all stages but showed small contrasts. The edge of the bone opposite the cutting, an area of peri-remnant bone thickening was formed. This peri-remnant covering has its greatest density on the circumferenc Without having to go into detailed discriptions of other experiment it is possible to summarize the results of the experiments. The degree of healing of the bone thickness in the experimental dogs was considera ly higher than in the control dogs. Thus, for example, the first signs of development of bone thickening (growth) in the control dogs appeared towards the 2oth day, whereas in the experimental dogs, towards the 1oth day. On the 2oth day of observation, the bone overgrowth in the experimental dogs appeared in the form of a protuberance on the opposite side of the surface-sawing of the radius bone. The sector of the radius bone in the area of sawing was compacted (filled in). Towards the 6oth day in dogs of the series mentioned, the effect was already unopserv- able, whereas in the control dogs, it persisted at the edge of the radius bone.

By comparing the X-rays of dogs of both series on the 9oth day, it was established that in the experinental dogs, a total regeneration of the structure of the radius bone took place, in the control group, the localitu of the sawing was visible in the form of a thickening of that part of the radius bone. Histological experiments also point to the indubitable effectiveness of stimulaing lasers on bone regeneration.

What is the mechanism of such action? Does not warmth influence the rapidity of the regenerative processes? (Diagram 4: X-rays of the radius bone of dogs, 15th day after fracture: A.. control group, B.. stimulation by laser radiation).

Putting the question in this way is apparently insolvable, since thermal effect cannot contribute its healing effect to biological activity in connection with the fact that hardly any heating of the tissue during radiation takes place. For example, during an exposure of ten minutes, at radiative piwer 1o-12 mW/cm sq the local heating of the tissue all-in-all comprises from o,5-1 degree centigrade Such a thermal heating can hardly bring about such manifest physiologi- cal and morphological changes the regenerating area. At the same ti one should not totally refute that thermal phenomena do not manifest a certain influence on capillary - trophic surfaces. However, such activity is not so manifest as to influence the speed of regenerating processes so that one could be in a state to observe them in our experiments.

It is known that warm baths, and suchlike, heat tissue by 5-1o degrees C and more. By increasing the temperature of radiation, acting on the contrary an inhibition of the regenerative processes takes place. At the same time, during the action of laser radiation of low intensity and exposure, the increase in temperature is several times lower. On the other hand, during the same intensities of the acting factor, no distinct stimulating effects in the dark-red part of the spectrum are observable, which confirms the frequency-dependant character of the activity of the radiating agent, in particular the He-Ne laser of wavelength 6328 A. This demonstates the resonance mechanism of action of the given factor.

We suggest that the basic matrix resonting on the action of menochromatic, coherent radiation, is the bioplasma. However, before going on to consideration of energy changes in bioplasma subjected to the activity of radiation, it would be expedient to review a whole series of other clinical and experimental data, demonstrating the non-thermal character and at the same time the highly stimulating action of He-Ne laser radiation.

Stimulation of regeneration by monochromatic red light. -4

Numerous observations made in our clinic and other medical establishments point to the possibility of beneficial action of He-Ne laser light on the process of the post-traumatic regeneration of skin. Initially, such data in the expeiments were obtained by D.L.Koritney during the action of non-coherent, partly-polarized, red light on the skin auto-transplant of a rabbit, of which we spoke previously. During very small intensities of from o.2-o.5 mW/cm^2 a distinct stimulating effect was obtained, at which it was observed that the first to react to the action of light were the regenerating processes in the connective tissue.

Clinical experiments were carried out to discover possibilities of utilizing He-Ne laser light for puposes of resonance stimulation of regeneration rrocesses in cases of trophic boils of various ætiology. Therapy of five patients suffering from trophic boils of ray-ætiology was carried out by the researcher from, Alma-Ata, K.D.Durmanov. The legth of ailment varied from 1-9 years, the age of patients varied from 23-67 years. Radiation boils were located in the area of the torso in two patients, the face in one, on the knee in one and the sole of the foot in one. The diameter of the boils (or sores) was from 2-5 cm. Exposure at intensity 25 mW/cm^2 was 1.5 minutes. The patients underwent daily radiation, over a period of 2o days. In all cases, positive therapeutic effects were obtained, expresssing themselves in the total healing of the sores. In the republic clinical hospital analogical results were obtained when laser radiation was used for curing protracted unhealing trophic cores. Of interest are experiments made by V.V. Makeyeva and collaborators, 1972 to discover the possibility of utilizing He-Ne lasers in the treatment of trophic sores. In 13 patients, the wounds appeared as the result of operative intervention, in four, as a result of traumas and burns, trophic sores as a result of thromboflibitis were noted in 8 patients. The maximum area of the sores was equal to 27 cm sq. All the patients had previously undergone conventional, and some of their number, operative treatment. The length of the ailments ranged from 1 month to 25 years.

The action of He-Ne laser on the area of the wound was carried out daily with an exposure lasting from 2o-3o seconds, with its gradual increase.

As a result of therapy, 19 patients after 25 sesioms, achieved total healing of wounds with the appearance of uniform tissue chitterling and epithelization, in 4 patients a considerable reduction in the dimension of wounds appeared. Already after from 3-5 sesions of radiation of was observed in the majority of patients a growth of granulations, the considerable betterment of their condition, the disappearance of pain in the area of the wound and normalization of sleep. As an example, we give here an extract of the case of a sickness.

A 35 yr old patient "G" entered the traumatological ward on the 1st Oct 197o after serious damage to the soft tissues of the sole and the large toe of the right foot. In the area indicated was a lacerated bruised wound with the formation of cutaneal shred on the sole. A surgical transformation of the wound was carried out by sewing the shred of the skin to its place. As a result, a total necrosis of the shred took place with the appearance of a granulated wound.

On the 21st of Oct 197o, an operation was carried out to cover the defect of the skin with auto-transplant, which ended within two weeks with the almost total ripping off of the previous transplant.

On 26 Nov 197o, the treatment of the wound by laser radiation was begun. Objectively: the wound of the sole area of the large toe is in the shape of rhombus, the area was 13.9 cm sq, the depth was 2-3 mm. At

stimulation of regeneration by monochromatic red light. -5

At the bottom of the wound, separate eyelets of granulated tissue were seen, in the form of droplets. The wound was bordered by tripe tissues (lacerated)

The separations were insuficien (poor), the periphery of the wound secreting as a result of swelling, were infiltrated and slightly torn up (lacerated), and at palpation, painful.

Summary: Two courses of treatment were carried out. The first of 27 sessions and, after a 1o days interval, a second, of 16 sessions. After the first session of radiating the surface of the wound with diffusely focused monochromatic red laser light, a zone of epithelia appeared on the internal edge of the wound and a bright granulated tissue appeared. In three weeks, the area of the wound decreased to 5.3 cm sq. That is, that the area of the wound decreased by 2.9% daily.

The condition of the patient is good. There are no complaints. After the second course of therapy the wound was totally epithelialized. We observe a distinctly expressed stimulating effect during treatment of trophic boils (ulcers, abcesses) of radiation etiology. As an exammple we present a case history of the illness.

The patient G, 28 years of age entered the long-term treatment clinic on Feb 1, 1968 with the diagnosis of advanced X-ray ulcer of the right heel. After a completed course of X-ray therapy in Oct 1965, due to a wart, an ulcer appeared. Ointments and physiotherapy turned out to be of no effect. The course of therapy carried out in Karananda and Moscow also did not give any results. After entering long-term treatment, the patient had anabcess measuring 3.5 cm with a smooth bottom on his right heel. It was round in shape, with a depth of about 4 mm. There were no perifocal reactions. The bottom was covered by meager (poor) rotting secretion of withered granulation. After laser ray therapy was carried out on the right heel in the Area of abcess localization compact dense fluting (scarring) in height not exceeding the surroundin sectors, was formed. The surace was smooth, there was scanty husking, the edges were well continued. No pain was noted. The result of the therapy carried out was evaluated as being excellent.

The patient was once more examined, four years after therapy. He feels well and no relapse was observable.

In this way, the above mentioned facts demonstrate that short-wave coherent red light is capable of recreating the regeneration processes on the merit of its biotic character, the character of its resonating action. In the burn ward of the republick clinical hospital of the ministry of health of Kazakh SSR, I.T.Kovinskiy, et al successfully applied laser light of low intensity for the stimulation of reviving ski grafts and the regeneration of wounds resulting from serious burns. Radiation was carried out for one day with the aid of a He-Ne laser type OQG-12, wavelength 6328 A. All in all, 16o patients underwent therapy. In their number (among them) 4o had second - to-third - degree burns, 6o had 3rd - degree B to 4th degree. As a result of thera a decrease in the healing period of burns was observed in from 4o-5o% of cases. The granulations are bright red, juicy, and tend to bleed easily. After 5-1o radiations, a violent increase of epithelia is observable. At the same time, the phagocytic activity of leucocyte activates itself which [illegible] the process of regeneration in cases of serious burn. Apart from that, it was observed that the radi ted auto-transplant revives more quickly. Extreme epithelia is accelera-

-ated, blood-supply is considerably better, and the growth of vascular networks takes place considerably more rapidly.

Histological experiments have shown that in radiated auto-transplants (grafts) a more active morphological change of structures takes place. As a result of the action of laser radiation, the oxygenation processes are enhanced. This reflects the magnified metabolism in the regenerating tissues, probably on account of the activation of oxygen in some cytochrome.

One should not fail to dwell upon the experiments on the stimulation of nerve regeneration during the action of laser light of low intensities, since they help us to understand the mechanism of the influence of laser light on the regenerative processes.

Considerable amount of work on this problem has been done at the Alma-Ata medical institute in the laboratory of Po Prof. A.R. Rahishev and his collaborator V.P. Tsoy , and in the electrophysiological section of the institutes of local pathology of the ministry of health of the Kazakh SSR, by P. Boyko and O.M. Ratzbam. In an experiment, V.P. Tsoy showed that during a the action of low-intensity laser radiation on a damaged isciatic nerve, a considerable acceleration in regeneration of electrophysiological functions is observed.

The data obtained demonstrate the specific stimulating action of He-Ne laser light on the regenerative processes in the nervous system.

In accordance with the experiments of O.M. Ratzbaum and Z.P. Boyko, during low-intensity laser light beamed on the neuro-muscular sample, a series of functional changes take place in it. The authors suggest h that He-Ne laser light of an initial power of o.5 mW/cm² basically acts during the first anelectronic phase of parabiosis.

We are in possession of clinical observations made on 9 patients suffering from spinal cord ailments (myelitis of different localization). Dr. N.I. Paremskiy attempted to utilize the He-Ne laser rays for the purpose of biostimulation of regenerative processes, as well as a factor against inflammation. 5 out of the 9 patients suffered from arachnomyelitis of an infectious origin, 4 whose illness was of a traumatic origin. There were 7 men and 2 women. The ages of the patients during the period of treatment were up to 2o years of age, 1, from 3o-4o, 2, from 4o-5o, 5, from 5o-6o, 1. The patients were invalids. The first group comprised 5 people, the 2nd 3, the third group 1.

In four of the patients, the illness progressed, with an increase in temperature and other general symptoms of infection: headache, incapacity (indisposition), cararrh of the upper side of the breathing channels. In the majority of cases, the increase in spinal symptoms was observed. In 4 cases, of myelitis of traumatic origin, a pain syndrome was predominant. The pains were localized in the region of the waist, loins, stomach, and along the ischial nerve. There intensity varied from being of a light, constant character, to sharp, shooting, or searing, pains.

In the great majority of cases, there were leg ailments, weakness of the hands was only observed in 2 patients. In 5 patients, paralysis and partial paralysis were of a spastic character, accompanied by hypotonic and high tendinous (sinious) reflexes. Paralysis and partial parlysis of a peripheral character with atrophy and hypertonic of the muscles , withering or absence of tendinous reflexes, in 3 patients.

In all cases, disarrangement of various degrees of palpability was discovered. The disturbance of palpability was of a conductive type. Other patients suffered from palpability

CHAPTER VII A WORD ABOUT BIOPLASMA

It was said by Biruni, the great wise man and encyclopædist of central asia :"the body of man is as light unto the world." In the east about a thousand years ago the idea was founded about the unity of the world. Man is not distinct from the universe, but is its microcopy. And so, we see already in ancient times the conception existed of a convergence between the microcosmos, man, and the macrocosmos---the universe. Thousands of years went by before the philosophical idea of the unity of the world took on a physical meaning. And here, already in our twentieth century you begin to truly wonder at the insight of the ancients.

In reality, the organism is built up of atoms and molecultes according to the meendelevian tables of chemical elements. Classically we find that the living substratum consists of substances or elements in liquid, gaseous and solid states. But could there also be a state of plasma in a living organism? We are accustomed to representing any object as being composed of atoms and molecules, but an object can also be represented as being composed of elementary particles or ions (plasma). Plasma is the fourth state of matter. It is at present possible to state with confidence that nearly all matter in the universe manifests itself as plasma. The macrocosmos is filled with plasma. Is the microcosmos therefore deprived of it? Does a plasma of a living organism exist? Some kind of special plasma, Bioplasma.

If the world is material and unified then one is obviously made to say ,yes! In fact, this state of matter--this plasma--is the most widespread in the universe surrounding us. Therefore, it should also be manifest in the living substratum. Perhaps because we do not know much about this living plasma, we are ignorant of the conditions neccessary for creating life. In short, a number of questions, presently unanswerable if one is confined to present theories of certain experimental facts, can be looked at in a new way concurrently with the planning of new experiments, different in principle from those previously carried out.

In 1967 we made the acquaintance of engineer V.S. Grieschenko who presented the hypothesis of bioplasma. In accordance with his presentation, bioplasma was made up of hypothetical atoms of IKS. Although we became fond of Grieschenko's hypothesis, at the time there were no concrete experimental confirmations. Later, when studying the literature, we discovered that the hypothesis of a fourth state of matter embracing living organisms was also advanced by the famous english physicist W. Crookes.

The science of polarized physiological energy was developed by the russian scientist M.V. Pogorelski in 1912 in his book entitled: "Electrophosphenes and energo-graphics." He noticed that photographs obtained in gas discharges reflected some kind of physiological states in living organisms and man: "All natural bodies and all living matter possess a known number of physiological energies which they constantly emanate from themselves. Exactly as all physical forces known to us like gravitation, electromagnetism (heat, light,chemical reactions), can also serve as sources generating this energy as well..

(Note: certain passages in this section ,corresp nding to pp5o-51 in the original manuscript, have been omitted as being redundant--Eds)

Academician E. Markowski, director of the biochemical institute in Bucharest who was in Alma-ata for a visit, discussed with us the conceptual state of affairs of the science of bioplasma. Ever since the 4o's Markowski has been developing models of living tissues being composed of very labile biostructures, organic clusters and water molecules, which make up the cells and membranes. After carrying out many experiments, he formed the science of biostructures whose

whose premises converge with the concept of biplasma. Not long ago, he sent his large monograph entitled "the structure of living matter" (Bucharest) in which he writes about the convergence of the concept of bioplasma with his biostructures concept

The Polish investigator V. Sedlak in a work entitled "A model of a system emitting bi logical and electrostatic fields" published in 1967 in the journal Cosmos, came to the conclusion that research into living plasma was neccessary. In a series of other works, he has advanced an intrinsic hypothesis of bioplasma (+). According to his suggestion, bioplasma has very similar properties to semiconductor plasma.

This has been a short review of the creation of the bioplasma hypothesis, that bioplasma is an unstable structure of living organisms

(+) See Sedlaks paper in Proceedings of the 2nd International Congress on Psychotronics Research, Monte Carlo, 1975, pp. ---Eds

We shall acquaint ourselves with the most important biological properties of plasma, as plasma is obtained usually on our planet.

The easiest way of forming plasma is to set up an ionizing gas discharge. During discharge, an electron-ion-avalanche is formed, and a gas discharge plasma appears between the electrodes. The number of positively and negatively charged particles is equal. As a whole, plasma is electrically neutral. Various kinds of vibrations can take place depending on the particle density. One of the properties of plasma is the collective character of processes taking place in part of the plasma. Plasma behaves as one whole.

With the help of magnetic fields the stabilization of plasma can be obtained. As far as energy radiation is concerned, plasma is an unstable medium. The discharge temperature of plasma is very high--up to 1 million degrees. The problem of creating maximal stability of gas discharge plasma is a basic task of modern physics.

Having read the above lines, some readers may begin to have doubts: is there hope among biologists in proving the existence of plasma in the -'soft' energy conditions of living organisms? How instable is the plasma? Do not hurry to join the sceptics since physics already has some data allowing the rejection of these doubts. It has been shown that under certain conditions, such as in atomic-molecular lattices, plasma conditions (objects with absolute instability) can exist. In solid-state physics, research has already been done on plasma effects in semiconductors, crystals and other matter.

The most characteristic thing about the solid-state plasma--in distinction to its gaseous form--is its instability, thermal equilibrium, and parametric differences depending on the state of the matter. In a solid body, electron-hole, exiton, and electron-proton plasmas are observable. The hole is a vacancy of the electron in a semiconductor. In contrast to the negative electron, a hole has a positive charge. A combination of a hole and an electron gives a neutral particle: the exiton.

The density of the electron-hole plasma in a semiconductor changes according to its temperature. During heating, the population of free electrons and holes are significantly increased. The density of solid-state plasma is optimally high: from 10^{13}-10^{22} electrons/cm^2. Consequently, the frequency of the plasma approaches the ultraviolet and visible portions of the spectrum. Each electron or hole does not belong to one atom only, but has broken free of the crystal lattice of the solid body and manifests itself as a part of the ensemble of the plasmic semiconductor. In fact, physicists have discovered a large class of convergences--organic semiconductors which are extremely close in structure to the structure of living organisms. Plasma conditions have also been discovered in organic semiconductors. Therefore, seen in perspective, there is a hope that a bridge can be built extending from the plasma of inorganic substances to the plasma of living organisms.

Further, a search of the biological literature shows that at present there is a considerable amount of information about the existence of free electrons and protons in biological objects. By the word "free" is understood an electron or proton which does not belong to a specific atom. That is, its position extends beyond the attraction radius of the atomic forces.

In 1967 St. Dierdi drew attention to the important role of delocalized electrons in biological processes. It was he who raised the question of research into semiconductor properties of biological molecules (white corpuscles, DNA, RNA, albumin, etc./) Many researchers point to semiconductor properties of DNA. The so-called π-electrons play a large part. In biological systems, for example mitochondria (respiratory cell organelles), electron transfer takes place through a small chain of respiratory enzymes. Iron is important.

through a small chain of respiratory fermentations. The role of mitochondria is very large in the process of energy conversion. Their number can for example be 10^5 which comprise about 1% of the weight of a human being. They create energy reserves in the cell on account of energy conversion emitted during biological oxidation into potential energy of rich chemical energy combinations. According to the opinion of the Polish researcher S. Monczarski in mitochondria are found electron plasmas with greater density than in the ionosphere.

Research made into the electrical properties of cell membranes carried on quite recently by L.A. Pirozyan and V.N. Aristarhov have shown the existence of semiconductivity in membranes. The role of membranes in biological processes is enormous. One can say that nearly all of these processes act thanks to the membrane. This, according to how many of them are found in one cell, is manifested by the electron photograph (illustration 5) made by us. Namely, membranes as we shall see later also appear as reservoirs where electron-hole exiton plasma is concealed (stored).

The plasma is formed on account of the ionization and formation of the localized charged particles. However, the converse process also takes place: the interaction of particles between themselves and their return to their binding with atoms. This process is accompanyied by the radiation of energy in the form of separate intensive quanta. Bio-luminescence of tissue and cells are at present intensively studied by the school of Prof. B. N. Tarusov, the chair of biophysics, Moscow state University. It has been established that during the exchange reaction process, the cells luminesce in the visible part of the spectrum. These are very weak-intensity streams of light which can hardly be magnified by highly sensitive light receptors (detectors) so-called photoelectron magnifiers. As mentioned previously, as far back as 1923 Prof. A.G. Gurvich pointed to the presence of radiation in the ultraviolet portion of the spectrum during cell splitting (mitosis) or during the death of cells. Discharges of light during cell death demonstrate the saturation of biostructural energy in the presence of charged particles.

In this way no mean amount of data (experimental facts) has been collected to this day. This indicates convincingly that free electrons and protons play a great role in the vital processes or organisms.

We suggest that bioplasma presented as being electron-hole and exiton plasma which localizes itself in membrane structures, among othe in mitochondria. This is the most labile view of plasma in the living organism. Apart from that, a more stable plasma is represented as being electron-proton. It is localized in the cell nucleus, the biostructural parts of the cytoplasm where no membranes are in evidence. This is visually illustrated on a simplified bioplasma model (illustration 6) showing a cell.

What distinguishes bioplasma from ordinary semiconductive plasma? Bioplasma is a thermodynamically non-equilibrium system but which possesses a large degree of stability in the scope of the conditions of living organisms. Its most inalienable characteristic is its anti-entropism.

Further, bioplasma is an organized system. Within itself it does not have thermal "noise". It follows that it is possible to speak of the bioplasma being a plasma at absolute zero. Of course, absolute zero is not brought about on account of the decrease or lowering of kinetic energy making up particles, but conversely, by a "knot of particles" put together by lines of a force-field penetrating them.

The [illegible] of particles according to energy values, the different types of force interactions between particles, the common

"binding" of them by electromagnetic fields of biomolecules,--- all this creates the basis of the stability of bioplasma during absence of thermal vibration and the direction of large reserves of particle energy. Absolutely, bioplasma is made up of oxygen ions, carbonic acids, and so on. It is possible to draw an analogy between bioplasma and ion-reinforced constructions where the manifoldness of material is made up of durable (solid) building material.

And so, the most important characteristic of bioplasma is its orderliness, its unusual stability during the time when it is saturated with energy.

Bioplasma is a medium in which different kinds of electromagneti acoustic, and possibly gravitational waves are distributed. The wave characteristics of vibration is such a medium are spread in definite cross-sections (planes) and can be polarized. There are reasons to state that it is characteristic for these vibrations to have a high degree of coherence, that is, their phase characteristics very strict coincide. Namely, a wave field has been "frozen in" as if with precise wave characteristics. It is as if a unique organismal hologr has been created. Every fragment of such a hologram possesses a characteristic of the most essential properties of the whole organi It is not true to say that being uncovered here are completely new approaches to the learning about the memory of the brain, or the nature of heridity.

The hologram "frozen in" the bioplasma is in fact a biofield. That is why we believe that the bioplasma is a medium in which it is possible to form the basics of the biofield and its fundaments. In keeping with our conception biofields are a synthesis of real physica fields with definite physical parameters and configurations. The conservation of parameters and configurations of fields is conditione by the bioplasma not possessing thermal noise.

In fact, presentations about the biofield are not new, and have their own history. However, at the time A.G. Gurwich developed scientific presentations about the biofield, they did not meet with understanding on the part of scientists, and hardly any speculatio on the significance of this problem was made.

The question arises: what is the nature of the biofield? How far does it extend within the living organism?

We believe that the matrix of the field is represented by the bioplasma. Namely the bioplasmal body does generate anisotropic field Anisotropy is an inalienable property of the biofield. The problem of interactions at a distance stands sharply and to this day, even thou proofs of its existence in man have been obtained, as well as in ma mammels and even in plants.

Let us now pause to look at some very interesting experiments of the American scientist K. Backster. He delved into the changes of electrical characteristics in plants during many fluctuations of the biofield. Such fluctuations, as the scientist rightly suggested, can occur for example during rapid death of the plant or animal, carri out in the absence of a human being.( )

( ) (Note: This section has been omitted since Backster's experiments are available in English. See, for example Int. Jn Parapsychology, Nr. 4, 1968 and Science, Vol , Nr. PP. , 1975 --Eds)

Independently of Backster's experiments, together with A.S. Romer in 1968 it was concluded that plants react to changes of fields in the human being especially during various autosuggestive states of directed character.

The effect was observed at a distance of up to 1 meter, and so, there exists a basis of data to confirm that the bioplasma radiates ar

ANISOTROPIC FIELD. ^ WE FIRST ENCOUNTERED

A WORD ABOUT BIOPLASMA -6

We first encountered the bioplasma during research made into living objects during gas discharges with the aid of the method presented with the assistence of Kdrlian (V.M. Inyushin 1966-67). As the research of V.G. Adamenko has shown the imaging of different objects with the aid of high-frequency currents were made with the aid of the phenomenon of cold electron emission.

Not only does the electron emission accompany a given process, i fact, other particles such as protons participate in it (see illustra Nr. 7). (Caption: Corona incandesence of human finger.)

If we thought of one of the emitters of electrons and other parti les as being a sector of a living object then in accordance with changes in intensity of emission it is possible to establish (postulat although obliquely, the electrical condition of a living object which is connected with physical processes.

In our laboratory, a special apparatus was created to measure the intensity of light radiation taking place in a discharge envelope. During research made into plants we discovered that the intensity of radiation is at its maximum in young leaves, and at a minimum in old o During the process of the research made at diminuation of the intensit of radiation was observed from 10-15%. After this fall, the significance of intensity remained unchanged. Metal plates, &physiolog cal solutions did not evidence the presence of such a fall (drop).

The change in intensity of radiation took place in all the leaves in the stalk and roots of the plant, In relation to the initial level. As a result of this, the forced"pumping out" of electrons and other particles brings about the gradual decrease in number of these particle in the whole organism, and this fact, namely, gives the basis to suppose the presence of an intrinsic electron-ion system in the organism.

Another experiment: it was enough to separate the leaf from the plant. At the moment of death, as we observed sharp discharges of radiation with its rapid extinction. How is one to treat this fact? Above, all, the cut-off leaf loses the stability which it possessed in being connected with the whole plant. But, there is no possibilit of compensating the lost charges during their emission. From this, the following regularity or conformity of such radiation or reaction can be seen.

In the other experiment, the plant was placed in a constant magnet field, the character of the radiation changed. The intensity was lower than when it was acted upon by the magnet, but the length of time of extinction increased by 2 or 3 times. The magnetic lines of force, hindered the easy extraction of electrons and other particles from the plant. All this also reminded one of the behavior of plasma in magnetic fields.

During the increase of blood temperature from 40 to 42.5 degrees C, an abrupt increase of radiation discharge was observed, followed by its drop. Something similar is also observed in the leaf. Would this be the critical temperature of bioplasma stability? It is possible that this is so. The disturbance of bioplasma sharply increases the possibility of the emission of the particles, increasing the brightness of the plasma radiation discharges. It is not without interest to observe that during the heating up of the shoots of plants at definite temperature intervals a bioluminescent discharge was observed (weak light conditioned by changes in properties).

A.G. Gurwich had, in fact, observed discharges of mitogenetic radiation during heating up. Could this be a coincidence? Unconditionally no. We suggest that the higher the density of the bioplasma and the degree of its organization, the more intensive the [illegible] of its radiation occurring as a result of the free

interaction of particles comprising it. During the disturbance of bioplasma structure a certain amount of heat should be discharged. In connection with this, one should not fail to mention the experiments carried out by the English discoverer Hill, in 1928. Hill discovered that the amount of warmth given out by some organic molecules during the absence of oxygen over a period of 24 hours is very great and cannot solely be explained as being the result of blycolysis and the fragmentation of ATF, etc. (ATP?---Eds). According to Hill, for 1 gram of muscle (sinew) one obtains 5 gms/cal. This exceeds by 5 times that which biochemical processes given out during muscle death.

Some kind of unstable structure is disturbed, depreciating its energy in the form of heat. We assume that such a large discharge of heat is a result of the distrubance of the bioplasma. This is the principal acculator of energy in the organism. But, hundreds of experiments are still neccessary to finally prove that the observed "thermal discharge" accompanied by the radiational discharge is, above all, connected with the loss (extinction) of bioplasma. Further discoveries about the bioplasma will help to uncover many of its properties. This is why we devote to this field of discovery so much time.

Extraordinarily interesting are experiments carried out by us which have enabled us to prove a chain of well-known properties of the bioplasma.

It all began with the attempt to give an explanation to experiment made by A.G. Gurwich, carried out in the 'twenties. Two roots of different onion plants were forced together. The distance between them being from 2-3 mm. The irradiating root (inductor) united with the onion-like plant were reinforced in a stative (mechanical support) and its end was trained on the zone of intesive cell fragmentation measured by the other onion-like plant placed horizontally. After this the number of cell fragmentations on the irradiated and non-irradiated sides of the root were counted.

The experiments showed that from the tip of the root of the inductor, radiation in the form of a narrow trained beam was emitted, which stimulated cell division on one side of the root. Barriers made of quartz glass did not disturb the effect, but ordinary glass absorbed the radiations. This spoke of the ultraviolet nature of the radiation.

In our laboratory, we decided to check on the experiment, but instead of using the small root applying the radiation, we placed a special plate covered with photoemulsion, a new acceptor for photoemulsion had been developed. The photoemulsion was protected from the saml root by light filters allowing ultraviolet to pass.

(Caption of illustration 8: Example of noncontact registration of mitogenetic radiation of small root of onion.)

After long searches, finally an optimal process of experimenting was found. The photoemulsion showed the image of the object in the rays of intrinsic radiation (see illustration Nr 8).

Analysis has shown a small angular divergence of radiation , that is, it is possible to suggest that every point source on the objec in fact generated laser coherent radiation. This once more proved, tha the nature of radiation is plasma in character. And the radiation itself is engaged with non-equilibrium distributions of electrons in biostructures. At the same time, it is neccessary to mention that there is a larger amount of excited electrons in biostructures than those which do not possess excitability.

The photograph shows a living small root which is conditioned by processes taking place in the bioplasma. The dying of the small root, brings about light radiation which illuminates the photographic film with a large aura around the object. The small dead root does not

at all give exposure of the photoemulsion. It is fully possible that the coherent radiation has in itself the hologram condition of the object. (see illustration 9).

(Caption of illus. 9: An example of noncontact regisrration of a rat liver in the wide band of the spectrum)

What efforts need to be expended in order to decipher this information? That this isn't fantasy, photographs of V.P. Kaznacheyev and collaborators also show. They have discovered a psychopathic effe which is in accord with the text of Diplom thesis Nr. 122 which to begin with formulates the following way: (page 67) "It has experimenta been established that the earlier unknown phenomenon of distant intercellular electromagnetic interactions between two cell cultures during the action on one of them by factors of biological, chemical, or physical nature with the characteristic reactions of the other (intact culture) in the form of 'mirror' cytopathic effects, that define the cell system as being a detector of modulating properties of electromagnetic radiation."

(Note: the comments of the author's above may be too brief to those readers who are interested in repeating the non-contact method of registration of biofields. Fortunately, this procedure is described in more detail in some other papers by Inyushin, and these are being translated separately and will available shortly. The experiment has also been done in Copenhagen and one of the authors will publish the details of the arrangement shortly.)---Eds

On the other hand, already separate work is appearing in which the possibility of the building of biohologrаphic models of brain memory are being considered. (Footnote 1: S.N. Braines and A.I. Suslov: "The neurophysiological analysis of the biohologrаphic model of brain memory." Thesis of the all-soviet conference on bionics. N.,1973.)

Thus, it is possible to suggest that the presentation of the biohologram is not a myth, but a scientifically demonstrated fact. Naturally, the fact that many experimental proofs are needed in order to confirm this conception in science without doubt presants itself. With the help of radiation of bio-objects we can determine the condition of the bioplasma and this opens new possibilities in medical diagnosis.

The energy state of bioplasma in the narrowest sense depends on "the breathing" of the cosmos. The biosphere is subject to the interaction of gravitational, and other various cosmic fields. The streams of plasma direct themselves towards the earth.

Disturbances on the sun create "noise" in the harmonic bioplasma and at small stability , disturb it. Facts of solar activity influenci life are at present the property of science, thanks to the work of the Soviet scientist A.L. Chizhevskiy.

Depending upon the position of the planets in the solar system, the intensity of electrical and magnetic fields on Earth change. The bioplasma cannot "cease to breathe" in one rhythm with the cosmos. Hence, naturally the observable rhythm of biological processes. We reap the fruits of solar storms in the form of infarcts and insults, the outbreaks of epidemics and so on, but the mechanisms of such happenings are up to the present time puzzling. (Note: infarcts: from the latin infarcio, necrosis of organ or tissue, the result of arrested circulation. insult: from the Latin insultus: disturbance of brain blood circulation e.g. artereosclerosis---Eds). It is possible that biplasma will enable us to clarify much better the affinity of life with the cosmos.

Illustration 1o shows graphically how the intensity of light radiation (electrons) in the luminescence fluctuates in living organisms. Measurements were taken each hour.

It was observed that a sharp increase in electrobioluminescece wa observed at 2 AM and 6 AM. Hence, a 24 hour dynamic property of electrobioluminesence has been discovered. By what is it conditio ed? (Text of illustration lo: 24 hour dynamics of the intensity of electrobioluminescence in the skin of the ear of a rabbit.)

Specially organized experiments speak of the dynamics of luminese as reflecting the 24 hour progression of changes in the intensity of the electrical field between two gigantic plates of a condenser--- meaning the ionosphere and the earth. The ionosphere carries ac considerable charge, the earth being negatively charged. The rhythmical change of intensity by night is conditioned by the lighter emission of charged particles from the surface of the rabbit's ear during research made into luminescence in high-voltage impulses accordi to the method used by Kirlain and assistents. We have begun to learn that this phenomenon is more profound suggesting that the structure of the biofield should also rhythmically fluctuate. Research has been made into the 24 hour changes of anisotropy of the biological objects. The ability to turn the plane of polarization of the ray has turned out to be dissimilar during night and day. What is characteristic is that a change in the direction of the turning of the plane of polari- zation takes place at different hours of the 24 hour day.

And so, the ordered structures of the bioplasma isn't so "crude". The structure is changeable, and depends upon the changes of the rhythmically pulsing structures of the gravitational and electrical field. Experiments have revealed a completely new field----discovering the science of biorhythms in connection with the conception of the bio- plasma.

The bioplasma is saturated with vibrations possessing very spheci:al characteristics, such as: coherence, and polariaation, Vibrations in the red band of the spectrum being dominant. The red resonance is in itself a symbol of highly-organized life. That, is in fact why it is possible to have such fine (precise) regulation of biological processes, with the aid of radiation energy generated by the helium-neon lasers.

As far back as the 3o's, E. Bauer said that polarized ray emission should possess larger biological activities than depolarized light. However, experimental data on the role of polarization in photobiologic reactions is small, although the formulation of such a problem in our days is all the more topical, in connection with the neccessity of carrying out research into the mechanisms of the activity of monochrom- atic polarized coherent laser radiation.

In our laboratory we carried out a cycle of work on discovering the role of polarization and coherence in the biological activity of light. It was learned, above all, about the influence of polarized and nonpolarized light on breathing and photosynthesis during equivalen intensity of light. The breathing of the shoots of plants was determ- ined by means of a gas analyser analyzing CO_2. The Helium-Neon lase with wavelength 6328 Å with ray intensity falling on the camera being at o.1 mW/ cm^2 was used as the source of radiation. The weakening of the rays was achieved with the help of neutral light filters and the depolarization of radiation was achieved with the aid of ground glass.

Depolarized radiation brings about a sharp decrease of respiratory intensity. The experiments were well carried out. Thus, it is possible to speak of the large role of linear polarization, in the photocatylic activity of light on the complex chain of processes during respiration.

Possibly, the effect is conditioned by the electric and optical polarity of the biosubstructure, about which we shall speak below.

During another experiment, we made research into the influence of polarized light on the synthesis of pigments. For this, two groups of plants were grown. One under polaroid film, another under a neutral grey light filter. Illumination in both cases constituted from 1ooo-1,2oo LK The results have been presented in table 3. (Caption of table 3: The content of pigments in leaves, 4-day growth, in mg %)

The phenomenon of accelerated synthesis of pigments during the activity of polarized light is observed. It follows that the photosynthetic productiveness of growth will also be higher. The experiment shows that changing the regimen of polarization of light we can directionally increase the photo-synthetic productivity. One of the most convenient group indicators of photosynthetic effectiveness is the rapidity of oxygen discharge. For the accurate measurements of this magnitude, it is possible to use the polarographic method of determining oxygen which contains in itself a high degree of sensitivity, non-inertia and allowing the observation of photosynthetic change in various experimental conditions.

As is known, the polarographic curve of oxygen appearance has two sharp plateaus parallel to the axes of the potentials. The plateau manifests itself as a result of the fact that during the potential corresponding to its beginning, the rapidity of appearance reaches significance at which all the molecules of the substance, in this case, oxygen, rapidly form (reform, restore). The establishment of oxygen is a very complex process, going through a whole series of more simple elementary stages:

The flow of the first half-wave, or semi wave, is conditioned by the restoration of oxygen to the point of peroxidity with the binding (joining) of two electrons. Depending upon the intensity of the processes going on, the magnitude of the restoration of the current changes, about which it is possible to speak about a concentration of restorative bodies, particularly of oxygen.

To express the results in absolute units, a periodical grading of the cell according to the oxygen content was carried out. The rate of distributing the apparatus was determined according to the magnitude of the limiting current, accompanied by the concentration of oxygen at 21 %, and comprised 9 x 10^{-4} moles/l. Apart from that, before each measurement, the volt-ampere curve of pure water, or buffer was checked, where the object experimented upon was suspended. The concentration of oxygen in the water within the radius of the cell was .oo25 x 10^{-3} moles/L . In the series of experiments made to learn about the influence of polarized and depolarized laser light, kinetic curves of oxygen restoration were obtained, according to which it is possible to speak of the change in the rate of photosynthesis.

The experiments were carried out according to the following scheme:

1) recording of the initial state of chloroplast suspension
2) activating the laser and simultaneous recording of the curve of oxygen restoration
3) Laser illumination in the period of a definite time period (1o-3o
4) the depolarization of radiation

As is the rule, in initial conditions the concentration of oxygen constituted from o.7o -o.75 x 10^{-3} moles/L . With the activation of the laser, a decrease of initial level to o.675 x 10^{-3} moles /L has been observed which apparently has been conditioned by the photostimulation of respiration.

Thus, in a period of 10 minutes, the concentration of oxygen increase and constitutes 0.77×10^{-3} moles/L. And after the elapse of 30 minutes, 1.65×10^{-3} moles/L. If the suspension is illuminated with depolarized laser light, then the curves sharply decrease, sometimes below the initial level of 0.155×10^{-3} moles/L. Changing the scheme of the experiment----illumination by depolarized and then polarized laser light brings about a similar reaction.

We give here the mean data of the experiments carried out in moles/liter:

inital level of oxygen concentration---0.75×10^{-3}
depolarized laser light ----------0.70×10^{-3}
illumination of suspended object
by depolarized laser light---over
a period of 30 minutes ----------0.29×10^{-3}
polarized laser light ----------0.775×10^{-3}

In another series of experiments the task was to explore the energy output of photosynthesis where use was made of He-Ne lasers as coherent polarized beams. For this purpose, a photocalorimetric method of a gradient-type was applied, whose advantage was its great sensitivity (0.002 degrees C) and which is extremely important in biological research. The temperature of the object being able to insignificantly vary from the temperature of the surrounding medium. The working principle or the calorimeter is contained in temperature changes of the suspension of chloroplasts during laser radiation and in remeasurement of temperature of the same radiated suspension, but in non-photo-synthesized conditions. The differences in temperature of non-photosynthesising (large T_{nps}) and photosynthesising T_p suspensions are proportional to the amount of energy stored during photosynthesis. The energy output is:

$$E = 1 - T_p / T_{nps}$$

The amount of absorbed energy of laser radiation was measured with the help of IMO-2 and comprised 8×10^4 ergs/sec. During the radiation of the chloroplast suspension by laser, the temperature curve fell. At the same time, a part of the light energy degenerates into heat, raising the temperature of the suspension and the cell. The more intensive the photosynthesis, the less absorbed light degenerates into heat,

Th

at is, the more intensive the photosynthesis, the "colder" the illuminated growth will be during the remaining equilibrium conditions. The energy output is calculated according to the following formula:

$$E = R/R_1 = R_1 + K(T_{temp} - T_1) = 1$$

where $E = 1$, and $R_1 = 8 \times 10^4$ erg/sec

R_1

R is the integral thermal effect at the moment of determination during the action of the light, K is the heat capacity of the cell at the calculation of the quantum emission (output) of photosynthesis expressed as r/a, where r = the amount of emitted oxygen in moles, a = the energy of the optical radiation in Einsteins of absorbed photons. We find that this amount correlates with the magnitude of energy output: the quantum output of photosynthesis during laser light illumination approached 0.2

In this way, while studying photosynthetic and nonphotosynthetic action of light, it is neccessary not only to calculate the intensity and spectral composition, but apparently the character of polarizatio and coherence of light radiation.

In the laboratories of biophysics of the faculty of genetic of growth of the academy of sciences of the Moldavian SSR, and in the Kishinev agriculteral institute S.N. Maslobrod carried out original research into the change of biopotentials of the leaves of corn when they were radiated with light with various wave characteristics. (footnote 1 : S. N. Maslobrod. "The electrophysiological polarity of plants" Kishinev, Shtiintsa publications 1973) It transpired that polarized coherent light creates the strongest photoelectrical responses in comparison with noncoherent and nonpolarized light of equivalent intensity.

All this once more confirms our point of view about the role of polarization and coherence of radiation in photobiological reactions. Namely, that the variation of space-time characteristics of radiation allow the establishment of a specific stimulation of biological processes thanks to the resonance mechanisms of interaction with the wave structures of bioplasma. The creation of lasers to work on predetermined frequencies has opened new possibilities for the induction of bioresonant effects. Not far off is the day when stimulated radiation of the biological part of nature will be obtained. It is then that the science of biofields will liberate itself from the accumulation of hypotheses and will become the arena of unique experimental research, the results of which will also lead medicine towards basically new horizons.

It is now, that we are just beginning to penetrate this earlier inaccessable sphere of knowledge.

Рис. 9. Пример бесконтактной регистрации излучения печени крысы в широком диапазоне спектра.

Illustration 9: An example of non-contact registration of a rat liver in the wide-band spectrum.

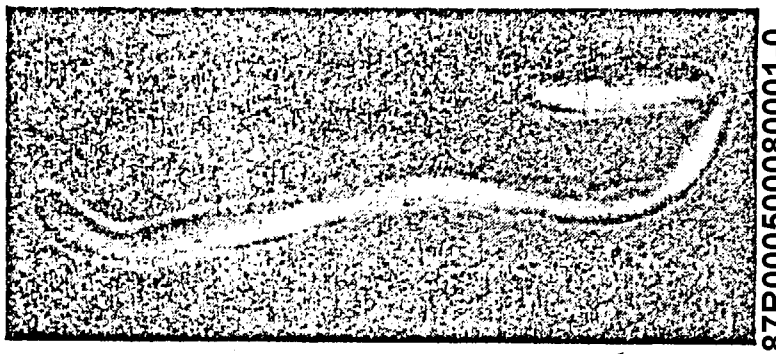

Рис. 8. Пример бесконтактной регистрации митогенетического излучения корешка лука.

Illustration 8: example of non-contact registration of mitogenetic registration of small root of onion.

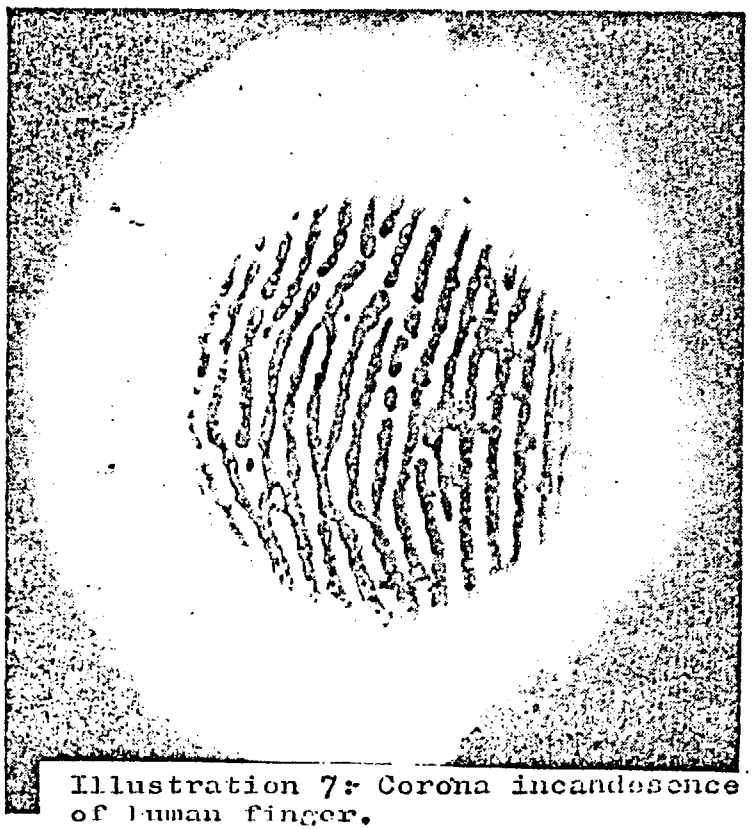

Illustration 7: Corona incandescence of human finger.

BIOSTIMULATION WITH THE AID OF LASER RADIATION THROUGH ACUPUNCTURAL POINTS — Chapter VII

For a comparatively long time the position has been held in medicine that the appearance of pathological processes are connected predominantly with the disturbances of the nervous system. A.D. Seransky has studied the causes of and mechanisms of the development of nerve dystrophies. It has been demonstrated that the reflex mechanisms are the cause of a series of illnesses. Well known are the classical experiments carried out by M.K.Petrova who was able to show how chronic nervous tensions create a whole series of pathological states in dogs.

Academician K.M. Bikov revealed the close interdependence between the core of the large hemispheres and the function of the innter organs. The Bikov school showed that exceptionally interoreceptive irritations can bring about the appearance of heightened excitation in ganglion isolated area. A characteristic viscous circle or pathological reflex appears and so the initial functional disturbances can lead to a phase of deep organic damage.

There is no doubt about the fact that the nervous system is one of the all-embracing systems whose role in the pathogenesis of many illnesses one may regard as the dominanting factor. It is enough to show that the nervous system supports the homeostasis of the trophic of the organs (A.D. Spiransky 1935). It is known that the hemodynamics of the nervous system is closely related to the functional status of the system. The regenerative processes come also under its control. The idea of nervism in medicine, is at present being successfully developed. (G.I. Kositsky, V.M. Smirnow 197o). It has been demonstrated that the leading role of the nervous system is apparent in a whole series of pathological conditions. Apart from this we believe that the most optimum place, for prospective application to the organism of low intensity characteristic radiation, for example, laser radiation, is the nervous system with its numerous receptor elements, conductors and peripheral centers, and entire sections of the central nervous system.

We have already spoken of the lipid membranes having semiconductor properties. The activation threshold of such membranes lies in the red light spectrum.

The existence of the most probable path from the conduction band to the valence band is shown by the bioluminescent phospholipid membranes in the red part of the spectrum. The phospholipid membranes are the basic builders of the material of the nerve tissues and neurons It is clear that red light of even low intensity should exert an activating influence on nerve elements. The activation, like the primary process, will manifest itself in the increase in concentration of the free charge carriers, the improvement of conductance, and the change in a whole series of physico-chemical properties of the membrane

Taking into consideration the comparatively deep penetrative properties of laser radiation into the core of the tissue, it is possible to subject to radiation by laser light of low intensity areas of the medulla oblongata, the spinal cord and also areas of the cortex of the brain. In this connection, laser light appears to be a quite convenient means of changing the energy balance of the nervous system.

The Special experimental work has shown the phase character of the reaction of the medullar section of the brain during the activit of low intensity laser light, λ = 6328A. (The part of the brain responsible for autonomic functions such as respiration---Eds). In the first variant, the frogs were radiated only with dissipated laser light, wavelength 6328A, intensity o.olmW/cm^2, and in the second, exposure time 2 minutes, intensity lmW per cm sq. The data obtainec demonstrate the existence of a distinct

replicating reaction (of the brainstem) to radiation. The amplitude of the reaction increases somewhat when the length of radiation is increased from 1-2 minutes. When the part of the brain mentioned is subjected to local radiation of greater intensity, the reaction takes place with some other variations of phase. To begin with, an increase in sorption is observed. Thereafter, its decrease. However over a period of one hour, the magnitude of sorbtion still does not reach the normal level.

Consequently, it is wholly evident that the presence of physico-chemical changes in the medulla oblangata of the frog both during activity and through the skin surface as well as directly on the brain are evident.

At the same time, it is an indisputable fact that the appearance of nidus (Focal point ---Eds) of persistent stimulation after radiation, the degree of which varies according to the sum total dosage of light impulses. As is known, N. Ye. Vvendenskiy, as far back as 1901, on the basis of experiments made on the nerve altered by various physical and chemical agents arrived at the conviction that apart from stimulatory waves, a gradual, long-term stimulation exists. He called a similar state parabioses. Such protracted stimulation ocurring in the medulla oblangata is capable of creating beneficial conditions for the removal of the "pathological dominant", from the vascular control center, and also decreases the intensity of pathological impulses from the periphery, which is of no mean significance in the treatment of hypertonic ailments.

Of great interest are the data relating to experiments carried out on the isciatic nerve of a frog. The nerve was subjected both to polarized and unpolarized light of equivalent exposure and intensity. During polarized light radiation, the viscosity was 1.5 times higher than during non-polarized radiation (Table 4):

TABLE 4: The dynamics of sorbtion (relative units of extinction) in the isciatic nerve of a frog subjected to He-Ne laser light.

RADIATION CONDITIONS	TIME AFTER RADIATION	M $\pm$m x10^{-5}	P
control	5 minutes	68.3 $\pm$ 10.3	0.001
	10 minutes	165.0 $\pm$ 49.3	0.1
	1 hour	195.0 $\pm$ 36.5	0.5
polarized monochromatic red light	5 minutes	203.0 $\pm$15.1	0.001
	10 minutes	154.0 $\pm$39.4	0.1
	1 hour	221.0 $\pm$13.5	0.5
unpolarized monochromatic red light	5 minutes	140. $\pm$0.01	
	10 minutes	109.0 $\pm$ 10.2	
	1 hour	540.0 $\pm$ 177.7	

Consequently, polarized light is physiologically more active, and brings about stationary stimulation. Similar sorbtion increases are also produced by unpolarized red light, but longer periods are required. It is possible to suggest that polarized light, is more biotic and accompanies the normalization of bioenergetic processes in the membrane.

Special theoretical and experimental research has convinced us that a significant quantity of biotic frequencies are situated in the red hand of the spectrum. However the antagonism of biological effects manifests itself especially distinctly in this part of the spectrum.

(Note: antagonism: interference with, or inhibitions of an organism by the creation of unfavorable condi tions ---Eds)
This requires, naturally, higher monochromaticity applied to the acting radiative agent during therapy. The gas laser generates uninterrupted (continuous) radiation. With the application of glass fiber optics, the laser radiation energy can be transmitted to the most dispersed points on the body with tolerably high accuracy. The utilization of He-Ne lasers is conditioned by the fact that they generate red short-wave light, 6328 Å, as many observations have shown wavelengths varying from 6200Å to 6700Å produce the greatest physiological effect during photosynthesis and the activization of oxidizing phosphorization, and other fundamental bioenergetic processes.

The polarization and cohererее of radiation produces a supplementary effect.

The apparatus used can be variously constructed, beginning with apparatus for local application and ending with light ray baths used for total radiation treatment of the organs or patients.

As we have already pointed out, a basis exists for the assumpition of future perspectives of utilizing the spectral lines in the red part of the spectrum to bring about bioenergetic effects on the human organism. The most physiological, and consequently, bioenergetical resonance lines, are those situated in the short wave band of the red light spectrum.

The action of monochromatic light photons brings about the migration of quanta in conductive zones which effects a change in the energy balance of the organism. Apart from this, photons generate exitons and electrons, for whose transfer small amounts of energy are neccessary to carry them to conductive zones, that energy being equal to that of the photons in the red part of the spectrum. Consequently, the energy balance changes in the organism which is fundamental for the normalization of the physiological and morphologica state which exists depending upon the persistence of energetic parameters of the organism.

The migration of charges along the conductive channels which are predominantly in the form of nerves creates the foundation for the realization of the main requirement of bioenergy therapy: the energy "suboscillations" creates corollaries for the normalization of the energy balance of the organism, and consequently, the regulating systems. What is bioenergy therapy? Bioenergy therapy is therapy by an energy agent whose qualatative and quantitative parameters are situated within power and spacetime limits of energy process relationships taking place in the cell.

Laser therapy is a particular case of widely applied reserves of bioenergy therapeutic means. The utilization of short-wave red light spectral lines has many perspectives in connection with the fact that their parameters lie extremely close to those of the most fundamental bioenergetic processes taking place in the nervous system (red resonance). There can be no doubt about the fact that in the not-to-distant future, perspectives will appear for the induction of bioresonances in the green, yellow and violet bands of the spectrum.

The main principle of modern medicine is based on the application of agents which by their nature are foreign introductions into the organism and to a lesser or greater degree, have a toxic influence upon (antibiotic properties.) At the same time, other methods of therapy exist, for example, the utilization of properties that are intrinsic to the organism (hormones, microelements, vitamins, etc.) Such therapy has been named biotic. X-ray and ultraviolet ray therapy is a-biotic.

Low intensity therapy in the visible and infra-red bands is biotic ray therapy. Such light action does not produce any new processes in the organism, but either weakens or incfeases the existing ones. Light action stimulates the cell elements and nerve conductors. But it is neccessary to observe that this stimulation in is not unlimited, and can enter an arrestive phase. Thus, the phase character of stain sorbtion by the medulla oblangata or iscial nerves demonstrates the development of the so-called parabiotic conditoons during the summation of light impulses attaining a definite magnitude.

According to the opinion of N.S. Vedensky, parabiosis is a thorough stimulation, that is, a local, persistant, non-distributed stimulation. In the first (level) phase, the nerve loses its ability, in various ways, to react to strong and weak stimulatory agents, including light agents. Further, the nerve responds to the action of weak, and not to strong, factors. As the precess is lengthened, an arresting stage may appear, in the absence of an external visible reaction to the stimulant used. Consequently, when selecting exposure and intensity it is neccessary to work out the initial functional condition of the patients. With the presence of initial phases of parabiosis the reaction will be proportional to the length and intensity of stimualation. It is also indispensible to take into account a parameter such as lability. The more labile a nervous system is, the lesser the dosage neccessary. Here it is probably neccessary to follow the reccommendation of I.P. Pavlov: "There is no doubt that the dosage has a much greater significance downward than upward. The whole art of varying dosage is downward." (Pavlov Clinical Proceedings, Vol I, 1954, pp. 79) In order to select the optimal exposure, it is indispensible to carry out careful clinical and functional analysis. Particular attention should be paid to the lability of the vascular system and the electrophysiological indicators. During large amplitude changes in the filling of blood in vessels, the amplitude and frequency of biopotentials should proceed to minimal exposure and intensity.

It turns out, the results of electrotherapy can find wide application since the root of most ailments lies in the disturbance of the neurovascular trophic.

Naturally, the best results should be expected from neurogenic illnesses and inflammatory processes as well as disturbances of the neurovascular trophic. Positive results are to be expected from the various disturbances (arthroses) of serious neurological illnesses. Their use is not reccommended in states of acute vascular disturbances, pre-insultave or pre-infarctive states, acute inflammatory processes, with the appearance of sepsis, and various other diseases, when stimulated, may bring about undesirable consequences.

Quantum generator radiation therapy should be carried out in conditions which would be inducive to the maximum amount of bioenergetic resonance.

To achieve this, a specially equipped isolation chamber is required for the isolation of electromagnetic and sound waves, and maintanance of constant electrical parameters of the medium. Usually, in practical therapeutic work, and during experimental investigations, the electrical state of the air in the chamber is not taken into account. Such a situation is undesirable in the case of laser ray therapy. Accepted as a norm, are 15o-28o light aero-ions in one cubic cm of air. For this purpose it is possible to utilize an electrofluvial point-tip ionizer producing up to 5ooo aero-ions per cubic cm, regulating the number of tips on the filiment it is possible to achieve a regular amount of ionization in the region of 2oo negative ions/cm^3

In the chamber where radiation takes place, it is neccessary to maintain a weak light-green or twilight lighting. Light isolation prior to the procedure is carried out for 10 minutes. Consequently, the camera serves as a means to creating conditions conducive to the energetic calm of the patient's organism. In connection with this, only the inner endogenal pathological phenomena will bring about various disturbances in the bioenergetic system of the organism, i.e. non-stable characteristics. The problem of procedure timing also plays a certain definite role.

Apart from the bioenergetic processes, the most effective procedures are nocturnal, from midnight to 1 AM. In this period, it is possible to obtain the most pronounced resonance effects within a few hours after a single dose of radiation. However, morning procedures from 9-10 AM are possible. The anisotropic bioplasma is subjected to the greatest changes during the night from midnight to 6 AM. This is a period of least bioplasma concentration, -and that is why any weak action will be more effective.

Such diurnal rhytym of activity should be observed, especially during radiation of sensory nerve centers. It is known that night constitutes the "kingdom" of the vagus, for during the day, the tone of the sympathetic nervous system increases.

At present about 40 physiological functions are known, subjected to precise cyclical changes with a period approaching 24 hours. (N. A. Agajanyan, 1967.)

One of the important problems is to localize the activity. In physiotherapy, the discovery of the reflexogenic zones which insure the specificity of reaction of the various organs has found recognition (A.R. Kirichinskiy, 1959). Quite convincing physiological interpretation has been given to the link between the inner organs and skin surface. At present, no one is in any doubt that the processes taking place in the internal organs are reflected in the perpheries of the skin surface. The connections between the organs and parts of the body are of various type: taking place through the vascular, lymphatic, or nerve systems. It follows that it is possible to obtain a whole series of response reactions on the part of the internal organs when the reflexogenic zones subjected to the physiofactors gives The effect of a decrease in arterial pressure. Functional changes on the part of the inner organs of the minor pelvis are observable during action on the area of , however it is neccessary to take into account that the principle of strict segmentary innervation like that of the surface of the body as well as the internal organs are not wholly supportable, that is , the stimulation does not only spread in the area of this or that segment, but has its points of departure beyond its confines. This is conditioned above all, by the fact that some peripheral nerves or trunks comprise the fibers of several roots. All this disturbs the segmentation of body skin surfaces connected to the spinal braincord.

For hypertonic therapy purposes using the action of laser light, we chose a series of reflexogenic zones known physiotherapeutically. The most effective one is the gate zone (portal).

The other method of action on a pathological nidus is that of photopuncture. That is, the action of laser rays on the acupunctural points, localized on the surface of the skin.

At present, there is no concurrance as to the biological nature of acupuncture points. Chinese doctors as a result of thousands of years of painstaking observations have discovered six hundred and ninety three points on the human body, which if stimulated, produce fully consistent physiological reactions and therapeutical effects.

Accoring to Japanese medical literature, there are in all 120 points.

Some authors suggest that in the aspect of ontogenetics, that these points are the relics of atavistic (ancient) facrors in stimulating the sytem ontogenetically speaking, which are intricately connected with the nerve centers.

V.G. Vogralik (1961) suggests that the Chinese points represent the greatest activity on the system of "skin surface--internal organs" interactivity when projected on skin sectors. They contain nerve receptors carrying the stimulation in a centrifugal direction.

A.K. Podshibyakin (1960) concluded that the skin nerve points of frogs, rabbits, dogs and human beings correspond to points of bifurcation in the nerve trunks, especially in the area where they enter the skin. According to him, the measurement of characteristic physical active points is of great diagnostic value.

Data have been obtained about the majority of acupuncture points possessing higher electroconductivity. (V.G. Adamenko and V.L. Raykov 1969) Special apparatus has been built to determine the electrical resistence.

There has been talk about regarding the nature of acupunctural points as being semiconductive in nature. (D.L. Parmenyenkov, 1970) Thus, a typical volt-ampere characteristic was obtained, of a distinctl non-linear character. As a result of many determinations of electrical resistance magnitudes in acupunctural points in humans and animals, a distinctly significant statistical dependence of this magnitude on the polar character of the voltage applied was discovered (it was of a semiconductive nature).

In recent years, there has been a considerable growth of interest in research made into the basics of acupuncture --the fundamental principles. To demonstrate this, the ministry of health protection of the USSR has decreed that it is neccessary to develop research in this direction, and in 1972 an all-Soviet conference on acupuncture problems was held in Leningrad.

During the past 5 years, a series of experiments were carried out to discover the biophysical nature of acupunctural points and their interrelationships, at the republic ministry of health clinical hospital in the Kazakh SSR.

Laboratory assistants V.A. Hruschov and M.A. Vorobyov came V forward with some interesting concepts on the mechanism of the therapeutical effects through acupuncture points. They suggest that normally functioning biological systems possess the intrinsic condition of entropy balance expressed in the formula:

$$dS_1/dT + dS_2/dT = 0$$

where dS_1/dT is the rate of entropy change due to the forces disturbing the system from equibilibrium, and dS_2/dT is the rate of entropy change due to activity of forces regenerating the system. In the case of pathological changes in the system, the entropy balance is disturbed due to the increase of D dS_1/dt or the decrease of dS_2/dT. This leads then to the inequality:

$$dS_1/dT + dS_2/dT > 0$$ (i.e. the irreversable process--Eds)

The disturbance of the entropy balance is accompanied by changes in subject resistance. With the increase of entropy, the resistance begins at first to drop to a certain minimum magnitude, and then increases and reaches a significant point many times greater than the initial one. (A.K. Prits and M.N. Cherkas, 1970).

disturbance of a root type(binding?--Eds). The majority of patients had constipation and a disturbance of urination. In 3 cases, bedsores were observed. Clinical laboratory research showed that in 3 cases, leucocytes numbering 9-12 thousand were observed. The ROE increased from 25 to 6o mm. In a number of cases, sub-fibril temperatures were observed.

Prior to the patient's entering the republic clinical hospital o the ministry of health of the Kazakh SSR, they underwent a long-term concentrated treatment, consisting of disinfecting and dissipation methods (medicines) and sanatorium treatment.

However, in 6 of the patients, all the methods of treament enumerated above did not give any positive results. An, in Inly 3 we any permanent improvements observed. Thus, the existing methods of treatment of myelitis turned out to be noneffective. In connection with this, taking into account experimental data, all patients were subjected to courses of treatment of He-Ne laser light on "actove skin points" and reflexo-genic zones. Treatment a was carried out in a special chamber, which was protected by an electromagnetic scree

The results of treatment with the aid of laser radiation carried out in a period ranging from 2o-25 days, surpassed all expectations. First, after the course of therapy was completed, the pain syndrome completely disappeared. During and after treatment, a decrease in vegatative-trophic sistrubances was observed, a healing of bedsores, an increase in the elasticity of the skin, a decrease in the brittleness of nails, etc. All patients experienced a considerable improvement in their somatic state. In 2 a cases, an improvement in the kinetic functions was observed. (1 patient began to move about on his crutches, and another abandoned his crutches, and began walkin with the aid of a stick.)

Such are the experimental data and clinical observations demonstrating that under the influence of low-intensity monochromatic coherent polarized radiation, an activization of the energetic processes takes place in the nervous system. The frequencies in the short-wave band of the red spectrum turn out to have an energizing influence on nerve receptors. A significant role is played here by the second harmonic lying in the sector of mitogenetic radiation and created as a result of the absorption of 2 photons of red light from a He-Ne OQG.

Experimental and clinical data, presented above, contradict the views still held on the non-specific thermal character of the action of electromagnetic radiation on the organism of animals and man. What are the mechanisms of non-thermal effects of laser radiation? These questions can be answered after acquaintance has been made with the concept of bioplasma, through which the action of electromagnetic radiation is effected.

A completely new field of directed regulation of the bioenergeti state of the organism is being discovered. The resonance bioeffects induced by radiation force us to create new concepts about the living organism, as being a whole, in which the energeti c processes lie at the foundation of all manifestations of life. The concept of bioplasma has been formed, which better helps us to understand the cause lying at the foundation of life, and opens new perspectives for the directed influence on normal and pathological processes.

The many bibliographical data on the measurement of resistance of acupunctural points show that, in pathological cases the points utilized in therapy have a resistance that is many times smaller than that of the skin. And in chronic cases, their resistance attains magnitudes exceeding that of the skin. After treatment of illnesses, the resistance of the points is restored (.E.S. Vel'hover 1967, M.K. Geykin 1970, B.X. Shuyskaya 197o).

The dynamics of point electroconductive changes from normal to pathological states and again from pathological to normal, give groun to assume that these changes are connected with the disturbance of the entropic balance not only in the pathologically changed organs, but also in the points themselves. The parallel changes in balance in points and organs are explicible by utilizing the grasmic memory model (V.A. Hrushchov, 1972, 1973).

In contrast to other memory modesl found in the literature, the grasmic model ensures the time-measured disclosure of the incoming information beginning with symptoms of great est intensity which is very important in the present case. (N.M. Amosov, 1964, and A.A. Bratko 1969). The ememorization of information takes place in the memory cells, conventionally termed acceptors. The nearest analogy to acceptors are neurons, but they differen from them becaus of their basic simplicity.

An acceptor is a junction in which connections from and to it are led from other, similar acceptors. It is characterized by its stimulatory potential, dependent upon the number and intensity of the signals of inhibition and stimulation going through the connections. Allowance is made for signals to go in an opposite direction but with great suppression (reduction). Stimulatory and inhibatory signals passing through the acceptor correspondingly stimulate or inhibit it, and becoming weaker, continue further along the connection.

There are two basic types of acceptors: 1) primary acceptors which do not manifest themselves in the information memory processes. Their sole connection is either with a dator accepting information or dators from which information is extracted. 2) Secondary acceptor manifesting themselves in the process of memorizing information (storage).

The intermediary link in the creation of a secondary acceptor is a donor. A donor is a periodically occurring inhibitory signal in a random point situated in the memory block area in places where there is an absence of connections and acceptors. This inhibatory signal which removes the potential (depolorizes) from the most stimulated acceptors, forms a link with it. After the formation of the link, the inhibitory potential jumps to the potential of stimulati and as a result, the potential is restored to the most strongly stimulated acceptor.

The primary and secondary potential acceptor differences form a picture reflecting the character of the signals received by the model. The inhibitory signals coming from the donor erases this picture as though concentrating it in a new acceptor on account of the links formed. The formation of the next acceptor is characterized by the fact that apart from memorizing the new picture, it always creates a strong link between the previously formed acceptor on accour of its strong stimulation. Depending upon the specificity of balance disturbed, the chain stimulated is the one that is most strongly linked with the most stimulated primary acceptors. The circuit of acceptors formed reflect the consecutiveness of change of the stimulated pictures.

It is not difficult to see that, if in the process of memory creation, no signals arrive, then the consequent memorizing of pictures will bring about the doubling of previously registered chains. Depending upon the strength of links, this process can spring from one sector of consectutiveness to the other, omitting or gradually settling on the very same picture. Thanks to the occurrance of the inhibiting stimulating signal, the picture formed where the acceptors appear does not only reflect the signals coming in, but also those that arrived earlier. That is why the process of registering and distributing information in the grasmic memory model is connected to a unified whole, which apparently is very convergent with the processes that take place in biological systems.

On the bais basis of this model, let us now consider the connecti between the points and the organs. We have a memory block, in which there is a large amount of aeceptor circuits, appearing in the development process of the biological sample, they reflect the information of the entropy balance of the organism. From this number, it is possible to extract a group of chains (circuits) which are connecte by means of the primary acceptors with the organs in question, and their corresponding acupunctural points.

When the entropy balance in the organ or point is disturbed, a stimulatory signal appears on the primary acceptor and further on, on the group of circuits. Depending upon the specificity of balance disturbed, the chain stimulated is the one that is most strongly linked with the most stimulated primary acceptors. As a result of distributing the information down along this chain, the inhibitory signal reaches the active dators, whose work restores the entropy balance, then a pathological process appears in the corresponding organs and points, which is reflected in the resistance of these points.

The stimulation of points during therapy increases the disturbanc of the entropy balance within them, and consequently, increases the stimulation of acceptor groups and points connected to them. The increase in stimulation leads to the increase of the inhibitory signal normalizing the conditions of balance in the very point and organ. This is what achieves the therapeutic effect. The restoration of balance takes place more rapidly in points as well as in less-organized systems, then those which organs make up. The process of normalization takes place very gradually, which points to the complexity of the physiological processes restoring the balance.

The present model allows the restoration of the entropy balance during the action of the acupunctural points, not only in the organs, but in the the acupunctural points, since the connection between the point and the organ as well as the point-to-point connection are the same in the modelling process.

In the "Aksay" ministry of health child clinic of the Kazakh SSR, B.Z. Shuyskaya investigated the dynamics of the skin galvan¢c reactions of points. The apparatus used in the search for acupunctura points and the quanitative evaluation of their electroconductance was V.G. Adamenko's (1967) "biometer" composed of 2 electrodes, one of zinc and the other of brass, connected to a microammeter--type M-13 M-265 M, M-266M, M-95. During the search for points, the passive Zn electrode was attached to the hand of the a patient, and the other, active brass of copper electrode clasped in the hand of the experimenter was rolled along the skin of the patient. The moment the acupunctural point was discovered, the microammeter needle deflected, revealing the circuit formed between the Zn electrode, the conductive channel, and the brass electrode.

On account of the electronic level differances in metals (i.e. work function of the metal--Eds) a continuous EDS of points also appeared (electro-dermal-signal? --Eds) dependent upon the channel resistance adjusted on the scale of the apparatus (i.e. calibration--Eds).

For purposes of quantitative evaluation of resistance it is indispensible to work out the most optimal measuring conditions, since the amount of resistance depends upon the degree of skin moistu and the pressure of the active electrode on the skin, etc.

The following methods were used in measuring. The skin of the patient was rubbed with spirit. The zinc electroce was wrapped in muslin, soaked in a physiological solution for the purpose of increas ing sensitivity. If a low-sensitivity microammeter of the M-13o or M-265 M type is used, then the search electrode is slightly moistened. When both electrodes are moistened, sensitivity increases by a factor of 3-5. The most sensitive apparatus is the M-266M with an amplifier. Thanks to the considerable amplification, it is possible to work wity dry skin without the need of moistening it.

The constant pressure of the electrode on the skin is very important in the measurement of electroconducaance. We made use of a constant-pressure electrode which employed a spring mechanism.

For the registration of electroconductance in a dynamic state, we utilized a microammeter type M-95 with shunt. Electrodes in the form of Ag and Au discs of an area of o.25 cm^2 were used, which wer placed on the acupunctural points. After the sk in of the patient was cleaned with spirit, the neccessary points were found, onto which a conductive paste was applied, and then with the help of leucoplaster, the electrodes were fastened on.

This method permits the registration of simultaneous resistance changes in the various channels during the whole procedure of laser radiation, which is very important for the evaluation of the reaction of the patient to radiation.

Indispensible are further efforts to find ways or working out the most optimal means of measuring the electroconductance and the creation of sensitive apparatus that can be more convéently used. One of the ways to objectively evaluate the initial condition and reaction of the organism to radiation is a modified skin galvanic reaction, registering changes in electrical properties. A similar method, in the evaluation of emotional reactions, in both normal and hypnotic states, was applied by V.G. Adamenko and V.LRA ykov (1968).

During therapy of child cerebral paralysis, a monochromatic red light He-Ne laser, LG-75, 6328 Å, radiation power 25 mW/cm^2, was used Radiation was applied continuously with the aid of a concentrated ray which was dispersed by a light-training device along the acupunctural points. (T.M. Shakirov, 1972). The skin galvanic reactions were registered from acupunctural points on face, hands, and legs as reccommended. The registration of electrical signals from the points was EPP-09, enableing the gradual dynamical processes or normalizatio of locomotor apparatus functions of the sick children to be monitored. The electrodes were put onto a paste for better skin contact.

15 children, ages 3-12 were examined. 14 suffered from congenit encephalopathy. Of these, 11 from an extrapyramidic form, 2 from a pyramidic form, 1 from a mixed form and 1 from tortial distony. Depending upon the disease, the following points were taken for registration: sken'-men', Jau-Huey, shao-tse, tzyan-yuy, vey-guan', ney-tin, bi-quan'. The skin galvanic reaction registration was done over a period of 15 minutes prior to and after radiation on the first day, the 3-5th day, the 9-11th days, and after 25 procedures.

The curves obtained give a presentation of the dynamics of change of the whole complex of electrical properties in the organism of the child. Electroconductivity and the laser-induced potentials change comparatively slowly and the muscle potential action is distinguished by rapid changes. The muscular potentials connected with the activity of the muscular system permits the evaluation of the physiological activity of muscles, which is very important for the determination in objective terms of the patient's condition, When suffering from hyperkinesis.

In healthy children, in a tranquil state, the curves obtained during registration were characterized by slow waves. During muscular movement, and its voluntary interruption, high amplitude and frequency vibrations appear on the background of the slow waves, which are characteristic of muscle potential action. In healthy children, the character of the curves is more symmetrical, with sloping crests and gradual tapering off. In the republic specialist "Aksay" child-clinic, T.M. Shakirov and B.Z. Shuyskiy registered many skin-galvanic reactions from "active" points on the skin in healthy children, and they all have converging elements (seem to coincide).

In patients with acute symptoms of hyperkinesis, and changes in the tonus, many different kinds of electrogenic disturbances have been observed, different electrical syndromes and phenomena take place, differing from the norm (L.S. Petelin 197o). Characteristic of such patients is the high-frequency component which reflects a condition of muscular electric activity during voluntary interruption. L.S. Petelin (197o) observes that patients with hyperkinesis possess an increase in skin galvanic amplitude reaction and frequency of muscular vibrations (contractions) generally taking place in the form of salvos (spasms), developing synchronously. According to the degree of synchronization it is possible to conjecture the lability of the neuro-motor units, channeled into the motor activity.

In the majority of curves, a certain periodicity of electrical processes can be traced, which take on the form of pulse rhytyms, a series of pulses is observed with the fall in electrical activity. Quantitative differences in amplitude, duration of pulses, and frequency of bir vibration is observed. Unfortunately, due to the low speed of the registration, it is not possible to say anything about the frequency of vibration and the degree of synchronization.

As far as the amplitude of muscular vibration is concerned, it decreased from 3 to 5 times during the process of therapy. The decrease in vibration amplitudes is observable immediately after laser action. The curves representing the electrical conditions take on a "calmer" shape (form) and in the sick patients the muscle tone decreases, a weakening comes about.

It is neccessary to observe the presence In nearly all the patients on the 3rd and 11th day the presence of a reaction expressing itself in the considerable increase of the intensity of electrical phenomenon, the increase of the amplitudes of muscular vibrations, and intensification of hyperkinesis. These symptoms quickly disappear, and towards the end of the course of treatment, diminishing of high-frequency vibrations is observed, conditioned by muscular electro-activity. The decrease in amplitude of these vibrations is accompanied by a marked decrease of hyperkinesis in the clinical picutre.

In this way, the modified skin galvanic reaction reflecting the electrical condition of the organism permits the oblique (indirect) evaluation as to the degree of hyperkinesis dominance and permits the objective evaluation of the therapy carried out.

Apart from that, data can be found in literature pointing to the connection between skin galvanic reaction and the reticular formation of the thalamus, hyperthalamus, and the sensory area and cortex of the greater hemisphere. Consequently, by acting on the reticular formation by means of radiating the diencephal region with the help of the method described, it is possible to control the reactiveness of the individual. Together with the registration of skin galvanic reactions, indicators of electroconductance of channels were taken uniting the acupunctural points (microammeter M-95, with shunt, electrodes Ag and Au). Data obtained are presented in table 5.

Caption of table 5: Changes in the electroconductance of channel 127a-122 (left leg, in microamps) during MKS therapy of children suffering from cerebral paralyses.

The registration of electroconductivity was carried out until treatment on the 1st, 3rd, 9th, and 11th days, and at the end of the course of therapy (after 25 procedures).

On the third day (the sum duration of radiation lasting from 3-15 minutes) a decrease in electroconductivity by from 1.5 to 2 times was observed in comparison with the initial level. With the increase of the sum dose by a factor of 4-5 an increase in the electroconductance index takes place on the 9th to 11th day which remains high until the end of treatment (1.5-3 times higher than the initial level).

Of interest is the fact that the electroconductivity of channels increases sharply by a factor of 2 after a single dose of laser radiation and decreases below the initial level on the 3rd day. After threefold radiation, the increase of electroconductivity is again threefold (from 0.11 to 0.34 mA), with the initial indices on the 9th-11th day remaining at the same level (0.36 mA). The appearanc of a sharp increase in conductivity immediately after the laser action and appearing within 5-10 minutes was observed when both small doses (30 sec) and large ones (sum dosage towards the end of the course being from 34-134 minutes) were applied. Such an increa in electroconductivity is apparently connected with the photoconductiv effect.

Photoconductivity takes place when the photon energy of the stimulating light rises above the significant threshold. The red light energy in the waveband chosen by us is optimal for the emission of electrons into the conductive band.

On the basis of this it is possible to suggest that the generatic of "free" charge carriers and the occupation of electrons in the conduction band takes place as a result of the action of laser radiation which brings about an increase in electroconductivity. At the same time the high indices remain at that level (with slight variations) over a period of 15 min after radiation, which can be explained by saturation of electrons in the conduction band.

The decrease in electroconductivity on the third day is interpretable in 2 ways: firstly, as the intensification of the recombination processes, decreasing the concentration of "free" carriers, and secondly, as the reaction of the organism to the increased doses which bring about an arresting effect. The perpetuatic of the initial level of electroconductivity towards the 9th and 11th day is apparently connected with the establishment of new energetic homeostasis. The level of conductivity is maintained throughout all the periods of observation with the exception of a few increased indices immediately after the laser action and over a period of 5 minutes, therafter. The latter is typical of all cases, as has been shown above.

Such stabilization of conductive indices of a definite level which are maintained over a period from the 9th to 11th day (during all periods of observation), speak for the attainment of a definite saturation threshold, that is to say, within the first 10 days, with the increase of the sum (total) dosage, the electroconductive indicatiors increase to a definite limit. Concomitantly, an increase in the intensity of physiological reactions takes place obtaining its maximum from the 9th to 11th day of procedure. Towards the 25th procedure, a decrease in conductivity is observable, and after the action by laser a 3-fold increase---as compared with the initial level---is noted.

This high level persists during all periods of observation, which demonstrates the increase of the energy resources of an organism

During treatment of facial nerve lesions in order to objectively make diagnostic tests and with the aim of working out individual doeses of laser radiation a method of measuring eleetroconductivity of channels uniting the facial acupunctural points was applied. (B.Z. Shuyskaya, T.M. Shakirova, 1972).

For the purpose of searching for points and a numerical evaluatic of electroconductive indicators, we utilized the above-mentioned methods with the help of 2 apparatus: M-265M a and the M-266M with amplifier.

All-in-all 11 patients underwent therapy (10 children of ages fro 7-14, and a 38 year-old ill female patient), among them 3 suffered from permanent damage caused by poliomyelitis and one girl with post-traumatic neurosis of the facial nerve. The etiological moment in the remaining cases was connected with the chilling or were inexplicable. The dura-cion of the sickness ranged from 3 days to 19 years. Therapy was carried out with the aid of a light guide trained on acupuncture points.

For the evaluation of the significance of electroconductivity, healthy school children ages from 7 to 15 (54 persons) were observed (checked) for a norm.

The data obtained were processed using the variational statistica method (table 6).

We discovered insignificant assymetries of electroconductive indicators ranging from 15 mA in the control groups. Thus, points 25, 26, and 9 are weaker (from 4-7 mA), and points 12, 22, and 23 have electroconductive indicators (from 15-25 mA).

Increasing differences in electroconductance significances are observable. In children ages 7 to 11 the electroconductive indicators are significantly higher than in ages 12 to 15, which is apparently explicable by age differences in the reaction of the nervous system an receptivity of the child's organism to irritants .

In cases of facial nerve lesions, sharp asymmetries of electro-conductive indices are observable, at the same time it is neecessary during the process of therapy not only to be aware of their presence, but above all, their magnitude, degree of assymmetry, strength and distribution.

During the observation of children, a certain dependance of the significance of electroconductance on the length of illness and localization of the wound (trauma) was apparent, however owing to the few observations it is not possible to arrive at any definite conclusions on this plane (stage).

Nonetheless, there is literature which shows the changes of electrical indicat-or (particularly resistances) during pathological processes which were used to determine the stage and localization of the wound and to evaluate the effectiveness of the therapy carried out (A.K. Podshibyakin, 1962, V.L. Raykov, V.G. Adamenko, 1968, L.Ya. Mazo, 1969).

Observations of changes in electroconductance of acupunctural

points in facial nerve lesions show that in recent forms of sickness the conductive indices on the damaged side in places of the localization of the process is much higher than on the healthy side of the face. And conversely, in prolonged old forms of illness, the electroconductance indices are lower on the damaged side. This fact led the authors to speculate upon the problem of the selection of individual laser radiation dosages based upon the significance of electroconductive indices. Firstly, it was indispensible to decrease or increase the indices of conductivity on the damaged side of the face c depending upon the initial level, secondly to even out (equalize) the assymetry, thirdly, to bring the electroconductive index nearer to the norm.

To accomplish these tasks, careful measurements of electroconductance of facial acupunctural points were made daily at the same time of day, up to the procedure and after it. Each point was measured 3 times and averaged results were taken. Observations show that large doses of from 5-lo seconds on a point produce a decrease in the significance of electroconductance by a factor of from 3-5. Small doses (from 1 - 3 sec. on a point) increased the electroconductance indices by a factor of 1.5 - 3 (table 7).

Thus, the skin galvanic reaction taken from the acupunctural points reflects the human organism's reaction to the action of laser radiation. Evidently, the electrical properties of the acupunctural points can adequately mirror the states of the cortical and subcortical centers of the brain (cerebrum). Experiments have shown that the diameter of the points can vary from 1-8 mm depending upon the physiological condition of the subject. On such a point, surface changes in electrical properties take place, a totally different reaction to the influence of light and the manifestation of skin galvanic reaction.

What are the electrical and substational changes of acupunctural points as opposed to the skin sectors not having these points, on the activity of He-Ne laser radiation? For this purpose, experimental research was carried out at a frequency of 5o Hz with the aid of an apparatus assembled according to a bridge design with Ag-AgCl electrodes, the distance between them being 2 mm. The electrodes were given a potential of o.75 V. To begin with, control measurements of electroconductance magnitudes were made, after which measurements were made over definite time intervals after radiation.

The topography of active points on the skin of a frog were determined according to a scheme (matrix) supplied by A.K. Podshibyaki (1949).

One of the symmetrical acupunctural points around the zone of the ear situated on the head of the frog was subjected to laser radiation beam of a diameter of 5 mk (microns) and a duration of activity of 2 minutes, with the light projection to other skin sectors through a glass fiber light guide.

Vital (biological) stainings were carried out in both symmetrical sectors of the skin. The sorbtion dynamics was studied in the sector containing the active point, as well as in the sector absent of points (table 8).

The data obtained show that the acupunctural points are characterized by a lower level of sorbtion prior to radiation. After a single radiation profound substantial changes and distinct phase reactions were observed.

An hour after radiation, the sorbtion indicators returned to normal. Consequently, with the light intensity of o.1 -o.2 mW/cm^2 and duration of action 2 minutes, the substantial changes in the active points are of an opposite character (progressive).

It is possible to assume that stimulation gradually irradiates in the joint system. The electrical resistance after radiation in the active points decreases sharply (from 3o-5o % of the initaal level).

The D.C. electroconductivity of points have a definite daily rhythm. The minimum in the electrical conductivity was observed at 2 AM and a maximum at 6 PM. According to these data, the best time to carry out the procedures is during the night when the conductive systems of the whole organism possess a large reaction capacity. All the experiments carried out convince us about the fact that acupunctural points react to light activity and through them it is possible to influence a pathological nidus (focus of infection).

Up to the present time there is no agreement of opinion in the literature about the primary processes taking place in points during needling.

Together with the mechanistic conceptions about the therapeutic action of inserting needles fully substantiated opinion has been extablished on the possible energetic nature of the primary effects during the action of needling. (V.G. Vogralik, 1961).

As the above mentioned experiments show, changes take place in a whole complex of electrical properties: resistance, charged quantities, magnitudes of eggwhite globules (albumin), membranes and so on. Consequently, the most fundamental thing about the primar physical-chemical displacement (shift) taking place in the point during the action of laser light are the photo-electrical phenomena which also change the degree of bioplasma energy saturation which manifest themselves as initiators of acceleration or deceleration of physiological and biochemical processes.

It is possible to suggest that the localized reaction to "needling by light" takes place in the form of an axom-reflex mechani Such a reaction is expressible in various changes in the functional conditions of the corresponding organs, depending upon the intensity and duration of laser radiation action, that is, during laser radiation action on an acupunctural point, definite bioenergetical changes connected above all with the appearance of photo-currents along the conductive channels and recharging of the membrane structur will take place in the corresponding segment. A re-radiation (secondary) effect is also possible in the bioplasma channels.

The general raction of the organism develops as a result of the energy changes of the bioplasmas structures of cortex and subcortical areas of the brain and the reticular formation. One should not exclude the possibility of a dispersion of reaction along the nerve conductors which have a bioplasmal level and diverse (mani-fold) connections (for example, the triatic (trigeminus) nerve).

There can be no doubt that when the skin is subjected to the action of laser light a reaction on the part of the suprarenal takes place which has a phased character. (V.M. Inyushin, 197o).

To conclude, we consider that it isneccessary to examine in any illness expecially of a neuro-dystrophic character is connected with the bioenergy changes occurring in the whole organism which precede the biodynamic shifts.

Pathology is above all a change in the bioenergetic balance of the bioplasma, the disturbance of its stability. From this, a wholly systematic principle evolves which says that there are no localized ailment---all ailments are of a total character.

Local manifestations of ailments exist, but hardly any focus of the maximal expression of the most distinct bioenergetic and therefore also morphological changes.

All kinds of patho-bio-energetical changes can accumulate over a period of time up to a certain level which when reached are observed to have secondary processes leading towards considerable organic changes. The concept of G. Sel'e about the role of "stress" is also to be found in the framework of bio-energo-patho-genesis. Not only the nervous system but the whole energy system of the organism is involved in a bottomless (infinite) chaos and irreversability of chain reactions during the action of pathological factors. Disturbances of the resistance (stability) of the bioplasma is in "stressed" situations also bring about so-called non-specific symtoms of various ailments, apparently it is neccessary to introduce the understanding of bioenergetic "stress" which is the cause of many ailments.

It is known that the concept of Sel'e ignores the role of the nervous system in pathology and the principle of nervism in general. However, we know of thousands of examples showing that the condition of the nervous system and mental state determines the tendency of the organism to illness.

Painstaking experience and the gradual training in overcoming difficulties leads to the formation of a strong type of nervous system. If a person is kept away from activity, then the result is the formation of a weak type of nervous system. What is the question here? The conservation of internal energy means the investing in health, on the contrary. After all, it is known that if a machine is not in the process of working then it will last longer. With the organism the case is contrary, in a state of inactivity a decrease in energo-potential takes place, resulting in a decrease in resistance to illness.

The concept of biplasma to a certain degree explains the dependence of this apparent paradox. The optimal level of bioplasma is conserved within definite bounds with its constant injection of free particles. Injection is possible during the particle exchange (during particle exchange, energy is released) on account of mechanical, chemical, radiational, and other forms of energy. Thus, for example, when a muscle is contracted not only the transformation of the potential energy of bioplasma into mechanical energy takes place, but as a result of the appearance during this of the piezoelectric effect, a formation of free charges occurs, which go into the bioplasma supply (storage) occupying a definite location in this system.

The bioplasma, in conformity with our point of view, is formed by particles possessing various energy characteristics, in other words, their energy potential is of varied significance (value).

Such a varied composition is conditioned by different sources resident in the bioplasmal constellations, at the same time the injection of particles is only possible during the action of some kind of energy on the structure (chemical, mechanical, radiational, and other forms of energy).

That is in fact why it is neccessary that the organism should be in the sphere of activity of various (differing) stimuli. The various stimuli also form a mosaic of particles differing in their energy parameters and the formation of a specific bioplasma structure. Without the action of the stimulant, the organism weakens, as a result of homogenity in the energetic parameters of the particles which unavoidably leads to a structural disturbance of the initial condition of the bioplasma and the appearance of instability.

There can be no doubt that the "stress" situation brings about quantitative and qualitative changes in the bioplasma of the whole organism, which in the final analysis leads to pathology. We suggest that the understanding of the concept of "stress" including finding out about the bioenergetic interpretation will make it possible to fuse the concept of Sel'e with the principles of nervism At this level it is indispensible to go deeper into research since the Sel'e thesis is one-sided, in actual fact, rejecting the role of the nervous system in patho-genesis.

Thus, for example, the development of all the components of an inflammatory reaction, namely: the widening (expansion) of vessels (dilation), the intensfication of the permeability of the vascular tissue, and the appearance of secretion, etc, is the object of the regular influence of the nervous system. This is wholly understandable since we showed above that the level and energy saturation of the bioplasma assemblies of the nervous system compared to other biostructures, are considerably higher, hence the possibility of attaining "an energetical dictatorship". It is interesting to observe that patho-bio-energetic changes in the internal organs unavoidably indicate energy shifts on the surface of the human skin. The walls of the body in relation to the internal organs carry more negative charges, an exception is the cephalic brain and the nerve conduction channels (pathways) where a complicated mosaic of negative and positive assemblies put together form a quasi-neutral state. In the human organism it is possible to observe the presence of a preponderence of negative "ectosome" (negative shells) and an inner, positive "nucleus" (endosomes). With the increase in the electropositiveness of the internal organ, for example in the intensification of the inflammator process, on the surface and united (joined) sectors and points, zones with a large quantity of negatively charged magnitudes are formed.

While observing the electrical and quantum properties of the skin surface, it is possible to judge where the localization of the inflammatory process is, and devise preventive measures.

The presence of chronic nidus inflammations can not only lead to a decrease in the energy potential of the bioplasma, but also disturbs the autoregulatory mechanisms of processes taking place in the core of the bioplasma and linked up with the pathological wave. And this leads to a deformation of the biofield loci, a disturbance of the function, and finally the appearance of persistent morphological changes.

Of great interest in this context are the so-called auto-immunt illnesses. In such illnesses the antigene homeostasis is disturbed, as a result of which organosclerotic manifestations develop.

According to the views of V.P. Kaznacheyev and others the functional full value of the immuneo-structural homeostasis determine the occurrance and etiology (history) process of many illnesses. If its function happens to be disturbed, then this may lead to two extreme cases: a) benign and malignant tumors, b) to distrophy and sclerosis.

We suggest that the disturbances in the immuno-structural homeostasis begin in the form of persistent undamped changes in the wave and quantum st-ructure of the quantum biofield. These changes take place under the influence of stress factors, for example, during negative emotions, functional overloading as a result of the action of physical and chemical agents and the influence of chronic inflammatory nidus. The latter brings about steady (persistent) informational [illegible] the stable

bioplasma constellations, located in the nuclei of the immuno-competer cells.

The non-resistivity of bioplasma is most distinctly manifest during changes in external factors, thus; with the presence of a large number of positive ions in the surrounding air, the inflammatory process in the organism progresses slowly owing to the large losses of negative particles and can take on chronic form. The level of energy resources of the sympathetic nervous system decreases sharply. In conditions of increasing pisitive nature of the atmosphere, the processes of infection take place more actively, invading new areas. With the presence of geomagnetic storms as a result of disturbances of the solar plasma a disturbance of the energetic connections takes place. In organisms with disturbed resistivity, a disturbance of energy balance, an intensification of inflammatory phenomena, and so on, takes place.

In this way in order to evaluate the bioenergetic parameters of the pat-ients' organism, it is neccessary to take into consideratio the electrical and magnetic condition of the environment at the same time. It is neccessary to know, that the reaction of the patient organism can be of an opposite (converse) type, depending upon the initial condition of the bioplasma system in a manner strongly reactin to shifts in the external environment, especially during a patient's illness.

A doctor should bear in mind that the bioplasmic system in the organism is united and conditions the many different levels of energy changes in it during the appearance of a pathological nidus. Shifts occur, above all, in the energy parameters of the central and most concentrated organized sectors of the bioplasmic system in the spinal brain, the ganglia, etc. At the same time, these changes can be both quantitative and of a space-time character. (Field time changes). In some cases of chronic illness, the pathological changes and their space-time characteristics become persistent (take on resistive character) even when the nidus of the illness is elimated. The long-term influence of the pathological impulses from the periphery can bring about the appearance of "local energetic focus" with an increased potential of an opposite sign in relation to potential of the neighboring areas in the bioplasma ensemble of the brain.

We suggest that this nidus can be seen primarily as positive bioplasmic particles. Such an energy nidus appears as a sort of trap for the impulses and free particles forming, as a result of the action of different stimuli, on the functioning organism (such an "attraction", to an even greater degree, disorganizes the autoregulatory system of the organism).

Such is the bioenergetic interpretation of the study of A.A. Uhtomskiy's dominant. This great physiologist wrote: "In connection with the formation of the dominant, the stimulatory energy contributi from the remaining centers flow as if to it, and these latter ones seem to be arrested (slowed down) as a result of their inability to react." The words of this prominent physiologist bear witness to the neccessity of discovering a bioenergy mechanism of the appearance of the dominant and its role in bio-energo-patho-genesis.

It is possible to suppose that even A.A. Uhtomskiy himself felt the neccessity of having a bioenergetic interpretation of the dominant, since by putting the question: "is it neccessary to present the dominant as a topographical single point in the central nervous system?" he answers this question in the following way: "it (the dominant) manifests itself most probably as a definite concentration of centers of heightened sensitivity to various niveaus of the cephalic and spinal brains, as well as the autonomic system."

This very well coincides with our conception about the inevitabl compactness of bioenergetic changes in the interconnected loci of the bioplasma system.

It is known that the presentations on the occurrance of patholog ical dominant lay at the foundation of the theory of pathogenesis of many illnesses. The removal of the dominant nidus, means finding the key to the treatment of many illnesses.

The methods of resonance biostimulation, as has been shown above, paves the way to "extinguishing the dominant of pathological niduses, and their return to normal status".

The residues of the sickness after an apparent recovery may be the result of insufficiently effective therapy. It is possible that they are conditioned by the consequent phenomena in the bioplasmal system, which are not always successfully removed by therapy and which make the organism receptive to pathological shifts in the presence of unfavorable factors in the environment.

The basic task of laser radiation therapy is the creation of an energy "sub-vibration" (pumping) of the bioplasma substance of the organism as a result of which primarily an improvement in the neurovascular trophic takes place.

The second task is the normalization of the quasi-neutral condition of the bioplasma, that is, the reconstruction of its stability (stationary state) or the conditions of its maximum persistence (stabilization) of the bio-energo-stasis.

The third is indeed the most difficult task---restoring to their normal state the space-time parameters of the bioenergetic system of the whole organism. This concerns the rhythms and wave processes of the various frequency bands which it is neccessary to normalize in case of pathological disturbance. This task has so far, not been possible to carry out due to absence of knowledge of the above-mentioned parameters in a normal organism.

In the case of sharply decreased bioenergetic organism balance, the lability of the bioenergetic parameters in connection with the bioplasma's lack of persistence, it is neccessary to effect a "bioenergetic pumping" (sub-vibrations) for the purpose of creating an energetical basis for the further morphophysiological normalization of the organism of a patient.

The normalization of t-rophic interrelationships in the organisms and the restoration of conductive channels is one of the main directions taken in bioenergy therapy, and here the method of laser radiation action on acupunctural points has a great future.

In order to carry out such a complex operation as the normalizatic of the bioenergetic status of the organism through acupunctural points, it is indispensible to make a very accurate diagnosis of the energy condition of the organism. Namely, from the evaluation of the initial condition of the anisotrophic field of the organism (and here, the acupunctural points are one of the distinct manifestations of such anisotropy) it is neccessary to begin therapy using biotic agents. And here, an invaluable aid may turn out to be the development of electronic calculating techniques. With their aid, it would be possible to obtain information on the innumerable bioenergetic conditions of acupunctural points. A certain experience in this sphere has been accumulated by V.A. Bruschov and N.C. Dzevitskaya. Research has been carried out on a few patients with chronic tonsilitis. Measurements were made of the electroconductivity of 15 sectors of the skin surface of the human face. On a special model the magnitudes of electroconductivity were fixed in a dertain definite order with the aid of potentiometers. The most probable recipe for the activity of laser light rays reducing the strength

BIOSTIMULATION.... through acupunctural points -19

of the indicator lamps, which topographically are connected to the various sectors of the human face. With the sharpening (intensification of the process, the activity of definite points increases. During the normalization of the process, the probability of maximum electroconductivity decreases. Consequently, with the aid of an analog computer setup, it is possible to check the dynamics of laser therapy.

Illustration 10: 24 hour dynamics of the intensity of electrobioluminescence in the skin of the ear of a rabbit.

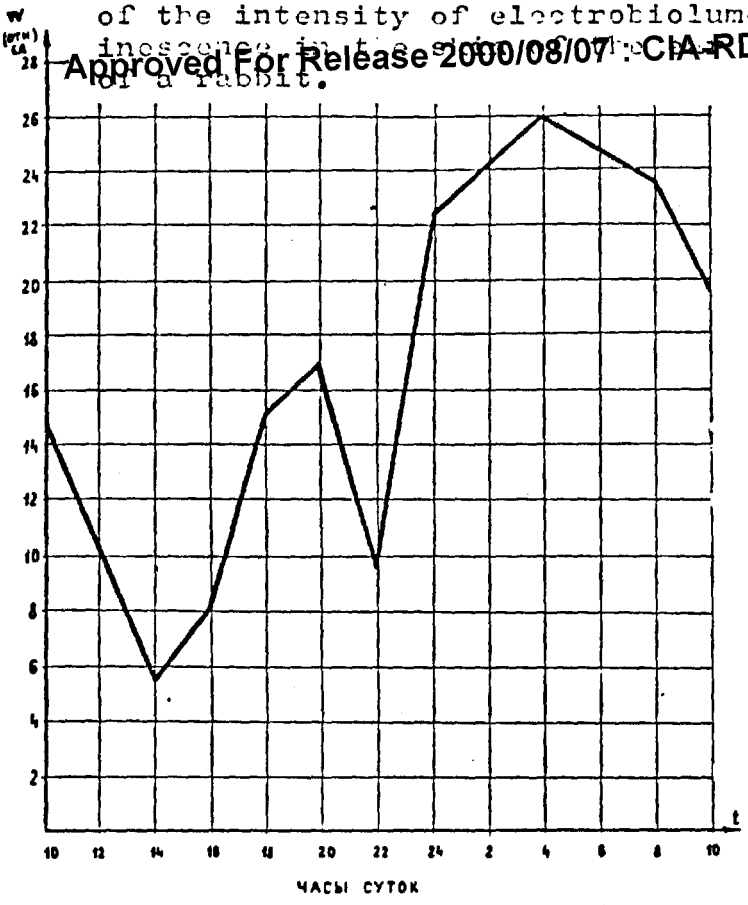

Рис. 10. Суточная динамика интенсивности электробиолюминесценции кожи уха кролика.

Fig 5: Electron microphotograph. Section of liver tissue. The numerous membranes are visible.

Рис. 5. Электронная микрофотография. Участок цитоплазмы

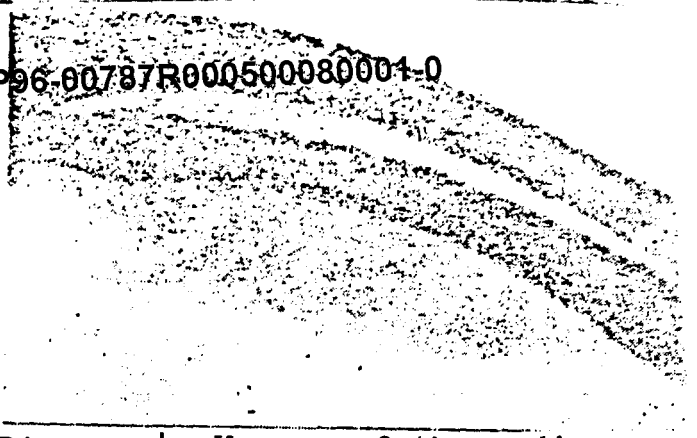

Diagram 4: X-rays of the radius bones of dogs, 15th day after fractu
a) control group b) stimulation by laser radiation

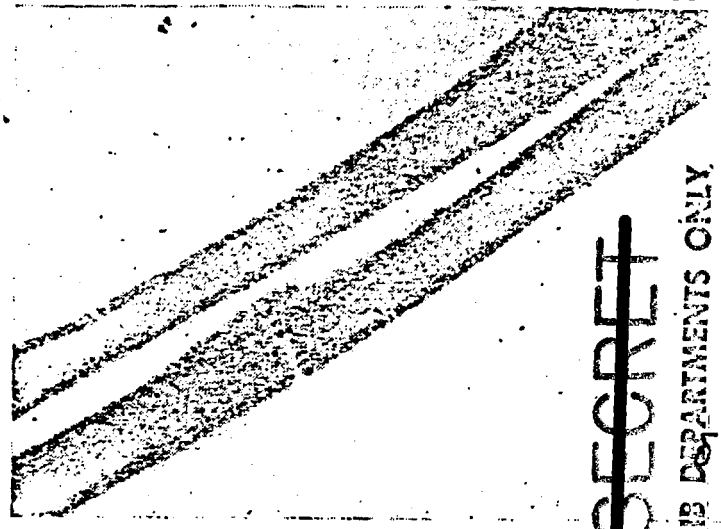

Рис. 4. Рентгенограммы лучевой кости собак на 15-е сутки пос. перелома: *а* — контроль, *б* — стимуляция лазерным излучение

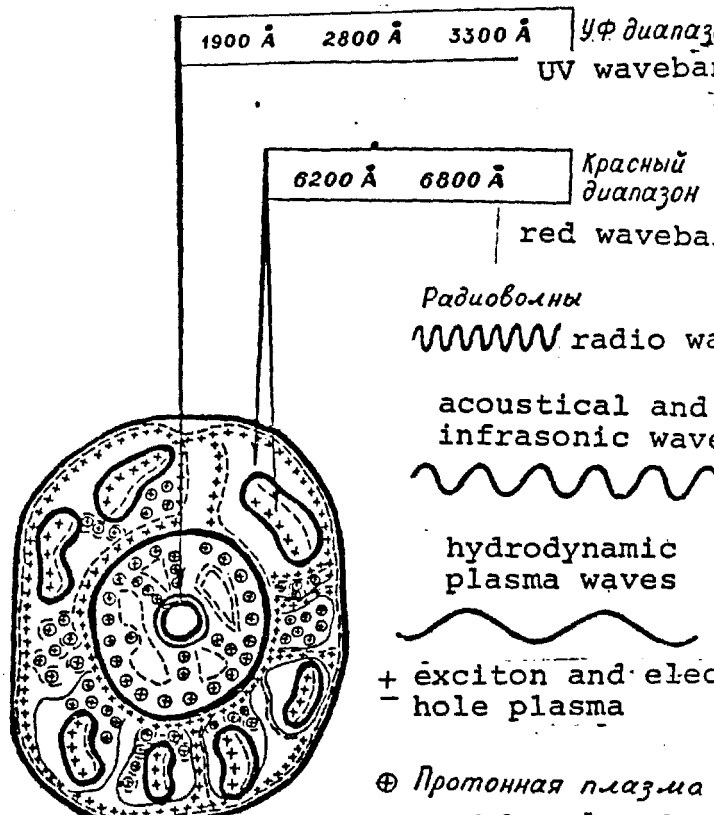

Fig 6: Bioplasmal system in cell and the dominating frequencies

CONCLUSION

Interest in bioenergetics is at present very great. It is in this science that one sees a sort of "savior" from the cold formalis of cybernetics the extraordinary amount of hypotheses in the sphere of molecular biology, the wild flowering of medical therapy, the increase of the preponderance of degenerative illnesses with various symptoms. In the theoretical area of bioenergetics a synthesis of the manifoldness of phenomena is expected, phenomena obtained in the process of large experimental work--many experiments.

In our book we have shown that the bioenergetic approach to the problem of therapy and pathogenesis of an illness is fruitful, since what we are concerned with is that we should treat the whole organss above all, as a bioenergetic whole. The organism possesses a considerable energy reserve which can be utilized in its fight with an ailment making use of very weak energy phenomena with the aid of laser radiation.

Bioenergetics also requires the revolutionization (revision) of many of our concepts about the living organism as a whole. "Namely, in the sphere of bioenergetics is concealed 'this biologica bomb'which will in the end enable scientists to reevaluate the present state of affairs as a new historical and logically indispens ible revolutionary stage in the development of the science of life, that highest form on our planet." These words of the famous academician B.A. Dombrovskiy are neccessarily the best the underline the significance of bioenergetics for the qualitatively new understanding of life in all its forms.

Science is fertile when it has further (long-range) perspectives and when it makes a positive contributaon in practice. And here, we come across the first successes of bioenergetics in both medicine and agriculture (1).

At the same time, the approach to the utilization of laser radiation in the given plan, is not doubly empirical, but is based on the foundation of definiate theoretical assumptions (hypotheses), such as the concept of bioplasma, etc. Intensive work has begun to decipher the mechanism of the activity of coherent electromagnetic radiations of low intensity on different levels of living organisation of the organism, which we wrote about in the foregoing chapters.

Ending the presentation of material, we consider it neccessary in a generalized way to throw light upon the initial (primary) mechanisms of the activity of HeNe laser light which in the final stage brings about a therapeutic effect.

During our investigations we hit upon an assumption: do laser photons not bring about changes in the qualitative parameters of the energy structure of the organism? In this context, it is interesting to look at A.G. Gurvich's idea that the photon with specific characteristics introduces a strictly determined metabolica process and determines the space-time existence of the process. Such assumptions are vindicated by the large amount of experimental material on the study of the properties of mitogenetic radiation.

It is possible to assume that such a high effectiveness of hyper-weak mitogenetic radiation depends upon a whole series of unique wave properties of living organismal radiations, above all, the high degree of monochromaticity of such radiation, its coherence and polarization. These properties create such a basis, thanks to which it is possible to induce resonance effects in the bioplasma and biomolecules with the aid of optical quantum generator radiation.

Every point of the biofield has discrete elements which are reduced by the regulating influences of the whole. The biofield interacts with [illegible] to the

the parametrical quantum amplifier. Amplification in the form of a cascade process takes place only as a result of radiation with definite wave properties. It is possible, and herin lies the secret, that during small (low) intensity mitogenetic radiation in the tissues a considerable macroeffect takes place.

One of these macroeffects is the increase in the permeability of cells during the action of mitogenetic radiation, the stimulation of cell fragmentation (mitogenesis). Mitogenetic radiation stimulates mitosis even in the frozen cornea of the eye of a frog. The introduction of so-called mitogenetic suppressives bring about a prevention of cell division. Consequently, the proliferative activity is regulated with the aid of radiation of strictly defined parameters.

Already attempts have been made to model the mitogenetic radiatio with very weak intensity sources of non-coherent and depolarized ultraviolet radiation. It was shown that the effectiveness of ultraviolet action is observable at a maximum of 2800 Å and somewhat lower in the area of about 2500 Å. At the same time, the stimulaTING effect of the mitogenetic radiation is cut off approximately at wavelength 2700 Å, and in darkness and at supplementary lighting by infra-red or visible light, displacement towards a more long-wave area of the specturm (3250 ± 60 Å). However, an identical effect was not obtained in the case of noncoherent, depolarized ultraviolet radiation.

It is neccessary to explain the possibility of imitating mitogenesis with the aid of laser sources. There are reasons to assume that mitogenetic rays possess properties similar to laser radiation. Possibly this is the secret of its high effectiveness. The presence in the cell of structures possessing semiconductive properties speak of the possibility of the generation of a laser-type radiation. An ignition of the mitogenetic radiation is observed during "energy pumping" by a weak, constant electrical current, visible light, and infra-red radiation. Consequently, the living cell can work like a self-constructed biosemiconductive laser. This is one of the suggestions. Another is also possible: mitogenetic radiation is generated by liquid crystal structures of the living systems. At the same time, the presence of coherent auto-radiation basically causes one to assume the possibility of resonance effects.

We are in the possession of convincing data about the fact that during the action of activity in waveband SVCh (visible light frequency) a resonance effect is observed. An so, the bacteriological (bacterocidal) effect of SVCh (visible light) frequency is observable on strictly determined frequencies, if the frequency is changed, the absence of the effect is observed (V.G. Adamenko, 1968, N. D. Devyatkov, 197o). Analagous phenomena are also recorded during the action of SVCh frequency effects on hemoglobins (L.G. Koreneva, V.I. Gayduk, 197o et al.)

Proceeding from the representation of the bioplasma as an organized semiconductive system, we assume that the resonance effects of radiation can appear at their maximum during a space-time correspondence of radiation with the wave and time structure of the biofield.

Weak radiations possessing strictly determined parameters can show distinctly expressed macroeffects, as is shown by the mitogeneti radiation.

The creation of lasers in different spectral bands creates the basis for their influence upon the endogenous ray processes with the aid of coherent electromagnetic radiations. The regenerative processes in different biostructures are usually stimulated by

chemical agents or by unspecified stimulants. At present we have almost approached the possibility of regulating proliferation by low intensity characteristic radiations. Although one encounters great difficulties on the part of creating a desired regulation, they are not insurmountable.

The concept of bioplasma, presented above, opens new possibiliti for the development of the study of bioresonance and its applica tior to medical problems. The real possibility exists of a direct indication of bioplasma radiation which can find application as a way of early diagnosis of illnesses, as also the reaction of the organism to specific irritants.

In connection with this is is desirable to observe the work of Prof. P.I. Gulyaev, from the Leningrad State University who with the help of a volume-data machines fixes the electrostatic field around a pulsing heart, a stimulated nerve, etc (2).

In the diagram below, we have attempted to picture the possible mechanism of resonance biostimulation by laser radiation.

Bioplasma is the most reactive system to the action of light in the red area of the apectrum. At the same time, atoms, molecules, and radicals interact with the laser radiations by emitting electrons in the zone of bioplasma conductivity.

The primary mechanisms of light action is "the energy pumping" o: the bioplasma with electrons and holes of determined energy stimulatic (in the range 1.2 electron volts). The red, short-wave light is the most effective for such bioenergetic pumping. By accumulating 2 photons, the biosystem is able to radiate them in the form of mitogenetic photons (thus, the energy of 2 photons wavelength 6328 Å is equal to the mitogenetic quantum of wavelength 3264 Å).

At the biophysics faculty of the Kazakh State University, it was possible to I.B. Beklemishev, V.A. Semikin, and K.K. Tleubayev to show in an experiment the appearance of UV harmonics during the action of various living tissues and plants by HeNe lasers. At the same time, cells having the greatest intensity contained clorophyll. All measurements were carried out with the aid of photoelectron apparatus (FEU-42) with luminescent screen.

Utilizing the photographic non-contact method of recording mitogenetic radiation, a co-worker of the faculty in question, L.A. Kiryeev, registered the ignition of a secondary radiation in the area 3100-3300 Å from the tissue of a green leaf during the action of light coming from a HeNe-laser. Consequently, the fact of generating quantum energy in the UV area of the spectrum, that is, mitogenetic radiation during the action of red light gas lasers, was proved. The part of the photon migration of mitogenetic radiation along the conductive channels of the whole organism was shown in the work of the successors of A.G. Gurvich. This is the source from which an understanding was obtained of the stimulation effects of low-intensities and exposure on the regenerative bone tissues, peripheral boils, and inflammations.

Namely, the secondary radiation also brings about a changes in the permeability of cell membranes, including also capillaries which also are of great significance for the resolution of inflammatory processes. The appearance of superfluous charges on the surfaces of membranes brings about the activization of the reticular endothelia (see diagram on facing page).

It is not excluded that the secondary radiation brought about by laser red light creates conditions for the improvement of inter-cullular tissue and organ contact. That is created for the bioenergostasis in all its manifestations (immuno-homeostasis, nerve-emotional, etc.)

These primary processes, taking place in the bioplasma and the biomolecular assemblies indicate the whole series of macroeffects: the appearance of energy homeostasis of the nervous system, and all other systems of autoregulation, because of the disturbance whose resistivity is the unbalancing of the bioplasms, changes of membrane surface properties and their pathological activity in connection with the increase or decrease of the optimal level of bioplasma.

The electrical state (condition) of membranes, their permeabilit which can be normalized by acting on the bioplasmal system with the aid of laser light. The stimulation of the changable process is conditioned by the electrical displacements in the membranes, which change their catalytic properties.

Acceleration of the acid-creative processes takes place apparent on account of the activization of the cytochromes of the mitochondri Namely, in these organelles the basic creation and accumulation of energy in the cells takes place.

The experimental data given in the book have demonstrated the fact of the presence of specific reactiveness, not only depending upon the frequency of radiation, but its polarization and coherence. Polarized and coherent radiation possesses more resonant effect on biological structures. In connection with the discovery of such resonance effects a quite new aspect of utilizing laser techniques in biology and medicine has appeared. In this work, only the physiological effectiveness of the short-wave part of the spectrum has been shown. There is no doubt about the fact that resonance lines also exist in other bands of the electromagnetic spectrum, for whose discovery further research is neccessary.

All of the experimental work has been based on concepts about the semiconductive structure of the living organism and in connection with this, the photo-electric phenomena taking place in the tissues in the presence of light.

At the same time it is neccessary to learn about the peculiarity of the physiological action of modulated light of a Helium-Neon laser, functioning according to a determined program on a living organism.

It is possible to suggest that stricter requirements to determin parameters of the radiation agents during its action on a living system with the purpose of inducing physiological resonances will be neccessary. All the experimental material gathered in the work presented confirms this attitude. In this book it is shown that it is possible to utilize radiation generated by HeNe-lasers in the form of a stimulator. The exposures applied manifested a stimulation effect on eritopoesis, the post-traumatic regneration of the skin, an synthesis of glycogen. The stimulation, as is usual, is of a parabolic character. The maximum of the stimulating effect is observed from the 3rd to the 17th day, after this, a characteristic fall on the part of the organism takes place which had been subjected to radiation action.

The initial bioenergetic condition of the radiated organ, or the whole organism determines its reaction on the activity of the stimulator. Radiation on the background of hyperfunction brings about a decrease in reaction, and conversely, in the case of hypo-function, its increase.

The diagnosis of the initial condition should be the most constant area of interest in biophysics. Knowledge about the initial condition will make it possible to more accurately make a prognosis of the direction which the physiological reaction during action of a radiation stimulator will take.

The basic results obtained in the process of our theoretical and experimental work can be formulated in a few statements:

Conclusion-5

1) spectral lines in the short-wave band of the red part of the spectrum (6300-6500 Å) have been discovered possessing physiological resonance effects.

2) polarization increases the physiological effectiveness (efficienc of radiation which makes lasers the most suitable sources of light for the stimulation of biological processes. (corpuscular formation post-traumatic regeneration of skin, etc.)

3) He-Ne laser radiation does not bring about profound organic chang in skin tissues; organs of corpuscular formation, and endocrinal glands, and quickens, or slows down the physiological processes depending upon their initial state.

This can be used or for purposes of normalizing a whole series of pathological processes which already are being carried out in practice in clinics.

Experience, amassed in the clinics of Alma-Ata and other towns show that non-medicinal therapy with the aid of resonance biostimulat ion in certain cases is considerably more effective than the best chemo-therapeutic agents, and in fact, do not create complications.

At the present time, experiments are also being made to find other ways of developing optical quantum generators. At the same time, attention is drawn to the role of secondary radiations of the bio-substratum for biostimulation.

It appears that real possibilities exist for the creation of a physical model of the biofield for fine (precise) regulation of many physiological processes of the organism, including those of the cephalic brain. It is not neccessary to prove the value of the results of such work for medicine, psychology, and agriculture.

The bioenergetics of the whole organism is on the rise. We hope that its achievements will serve to the benefit of the health of man, his physical and spiritual development.

In conclusion, we consider it essential to briefly dwell on some interpretations of the Kirlian effect which appeared recently in foreign publications.

Thus, for example, the gas discharge luminesence taking place around the human finger and its light effects was called bioplasma, when the works of Soviet researchers were referred to in the foreign press. This is in principle incorrect. In our work we have not once shown that the Kirlian effect is an oblique method of uncovering some of the ppoperties of bioplasma. We showed that the effect itself of the light from the gas discharge plasma within a certain period of time, is accompanied by bioplasmal luminesence, as a result of ion-electron bombardment. The intensity of this luminesence in the best of cases, does not comprise more than 15% of the whole light stream registered during the action of high voltage discharge.

Bioplasma possesses its own light (luminesence) but it is very weak under normal physiological conditions. The structure of this luminescence was demonstrated by us using the non-contact bioradiographic method, without supplementary influencing. During the Kirlian effect, we are able to observe a luminous ignition of bioplasma amplified a billion times on account of the electron-ion bombardment.

A significant part is also played by auto-electron emission in the formation of luminesence and image formation (especially in cases of utilizing luminophor or photoemulsion). For this reason, V.G. Adamenko has presented quite significant demonstrations published in scientific literature. In connection with this, one is filled with disbelief when confronted with the opinion of the American scientist W. Tiller (in Psychic magazine, 1974) that the Kirlian effect reflect the physiological condition of the living object, and that all displacements in the luminesence

take place as a result of the deformation of the empty space between the bio-object and the photoemulsion.

According to our viewpoint, the data obtained by W. Tiller are an example of the other extreme, when the researcher, not having understood the substance (essential point) of the Kirlian effect has completely lost that 12-15 % of useful information about the bio-object, which was present in the macro and micro streamers of the gas discharge over a short space of time. Apparently, enthused by the physical experiments, Dr. Tiller did not succedd in fixing this information and at the same time lost the nucleus of the Kirlian effect.

Only on the basis of quantitative evaluation of luminesence as a result of high-voltage discharge is it possible to obtain reliable information about the processes taking place in plants and man. This is substantiated by the numerous works about the Kirlian effect, presented in a series of scientific publications. The diagnostic value of the Kirlian effect does not arouse doubt. This method is one of the finer ones of evaluation the bioenergetic displacements (changes) in the whole organism. At the same time, it is also neccessary to accept the presence of "noise" information in the gas discharge, which as our research has shown can be differentiated (distinguished). One would like to pause here to mention a series of experiments which show that luminesence which takes place on the streamer contact (object) carries information of the physiological condition.

Thus, when the living or plant object is heated, an intensive light discharge is observed during illumination. During illumination of a leaf with light the phenomenon of charge polarization takes place and luminesence in the shaded sector drops.

Under the action of a magnetic field on plant and living tissue, the effect of a reduction of luminesence takes place which persists over an extended period of time, even in the case when the magnet does not directly act upon the living tissue.

The inhibition of breathing brought about by poisoning brings about a reduction of the luminesence of roots and leaves of plants.

Finally, one should not forget to mention some quite interesting experiments made in the Alma-Ata institute of medicine by Prof. A.R. Rahishev and collaborators. They discovered the changes of intensity of luminesence of palatal knot in cats.

The undamaged knot had a more distinct luminesence (2-3 times) than in the case when it was decentralized as a result of cutting. It was further shown that short laser discharges significantly changed the intensity of luminesence (1.5-2 times). All the experiments were carried out using lumiphor screens, the significance of whose light intensity was determined by a photoelectron magnifier. The apparatus was developed at the biophysics faculty of the Kazakh State University.

Without doubt, the Kirlian apparatus is far from perfection, and is one of the few accessible means for diagnosing bioplasma. At the same time, with the help of the Kirlian effect, it was possible to penetrate into a new field of knowledge, utilizing the most recent achievements of quantum electronics to obtain unique information about the bioenergetic state of the organism, and prove the existence of the biofield.

The work carried out in our laboratory demonstrates the possibility of obtaining information about biofields without supplementary influence (action) on the living organism.

Footnotes :

1) V.M. Inyushin and M.N. Fedorova, "Experience in the application of lasers in agriculture", Electron Techniques, 12th issue, 1970

2) P.I. Gulyaev, etal, "Electroaurograms of the human and a mammal" The Nervous System, Isvestin LGU, 9th edition, 1968

DIAGRAM OF THE MECHANISM OF LASER RADIATION THERAPY AS VIEWED ACCORDING TO THE CONCEPT OF BIOPLASMA.

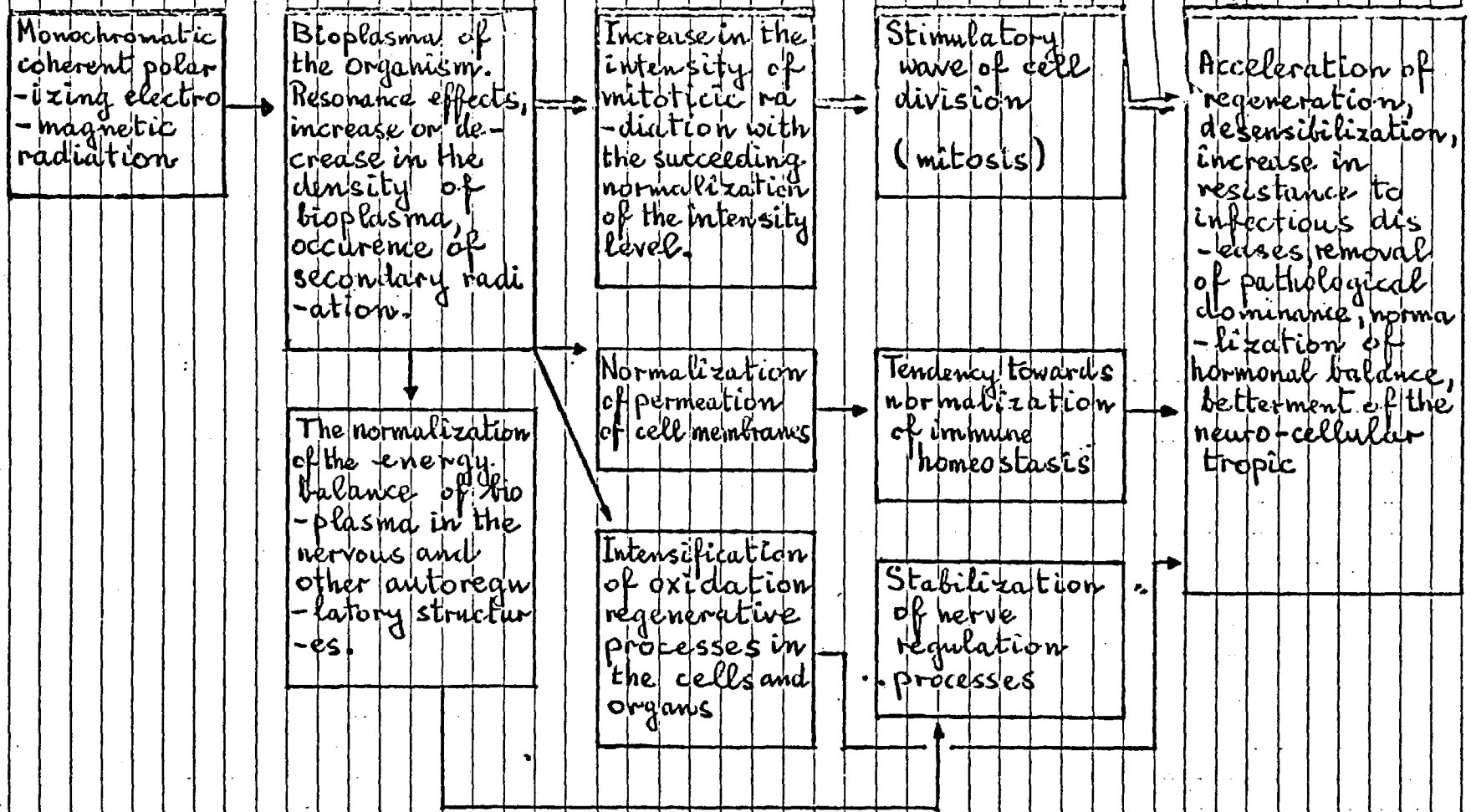

Table 8: Sorbtion differences of neutral red in the active points in the skin sectors of a frog. Without active pts. during LASER radiation in corresponding units.

objects	control	Post radiation time: 30 sec	5 min	10 min	1 hour
active points...	84.6 ±8.1	115.0 ±13.0	113.0 ±11.2	110.0 ±11.5	80.0 ±7.7
sectors without active pts.	114.7 ±10.5	134.0 ±14.6	114.5 ±16.0	109.0 ±10.4	120.0 ±5.8

TABLE I physical characteristics of soviet lasers used for biological research

RADIATION SOURCE	TYPE	OUTPUT in mW	weight, Kg
OKG-12 shock & vibration resistant	multimode CW	2o	16
OMG -13 shock & vibration resistant	multimode CW	o.2	1
LG-75 HE-Ne gas laser	multimode CW	25	28
LG-36A	monomode	4o	
LG-36a	multimode	8o	4o

Notes: CW= continuous wave, i.e. constant operation
OKG = optical quantum generator, i.e. laser

Table		
Pigment	Control mg%	Polarized mg%
chloraphyll a	1oo.o	12o.5
chloraphyll b	62.8	7o.o
keratin	3.o	3.2
lutin	2.o	3.1
violaxatin	1.6	1.5
sum of the green pigments	125.o	166.5

Table 3: The content of pigments in leaves:- 4-day growth, mg o/o.

Control		Polarization
clorophyll "A"	100.0	120.5
clorophyll "B"	62.8	70.0
karotin	3.0	3.2
lutine	2.0	3.1
biolaxatin	1.6	1.5
Sum of the green pigments	125	166.5

Table 5: Changes in the electroconductance of channel 127a-122 (left leg, in microamps) during MKS therapy of children suffering from cerebral paralyses.

Procedure	Total Dose	Initial data				After radiation by LG-75			
		starting level	after 5 min	after 10 min	after 15 min	immediately after radiation	after 5 min	after 10 min	after 15 min.
1st	30 sec to 5 min	0.18	0.11	0.22	0.52	0.35	0.38	0.31	0.42
3rd	3.5 min to 15 min	.41	0.19	0.31	0.22	0.34	0.27	0.24	0.31
9th to 11th	15- 63 min	0.36	0.31	0.30	0.37	0.52	0.58	0.38	0.39
25th	54 -- 134 min	0.26	0.35	0.45	0.49	0.55	0.54	0.59	0.49

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Table 6: Mean indices of electroconductance channels joining the acupunctural points in children (norm)

Age of children	No. of point	right	background	left	background
from 7-11 years	9	9.2±0.5	1.7	8.7±0.4	1.9
	10	10.2±0.3	1.6	10.8±0.6	1.9
	12	25.1±0.9	3.8	20.4±0.5	3.6
	22	25.0±0.8	4.9	24.0±0.6	4.2
	23	18.3±0.7	3.5	---	--
	25	6.5±0.3	1.3	6.8±0.3	1.5
	26	5.9±0.3	1.3	5.9±0.3	1.2
	103	6.5±0.3	2.2	6.9±0.3	1.1
from 12-15 years	9	7.1±0.5	1.5	7.2±0.5	1.3
	10	9.2±0.9	1.6	8.3±0.6	1.0
	12	12.5±0.9	3.0	10.9±0.6	2.8
	22	15.1±0.7	3.1	14.7±1.0	3.5
	23	14.4±0.7	3.5	---	--
	25	5.4±0.7	1.3	6.7±0.9	1.5
	26	4.7±0.7	1.5	5.5±0.7	1.0
	103	7.6±0.6	1.0	7.4±0.5	1.2
	3	9.6±0.8	1.0	---	--
	29	9.6±0.7	1.0	---	--
	33	5.7±0.4	1.1	---	--
	91	5.1±0.3	0.8	5.7±0.3	0.9
	113	4.8±0.3	0.7	4.9±0.3	0.9
	107	6.7±0.4	0.7	8.4±0.7	0.9

D. L. Parmanenko (1960)
Remarks: The point numbers are given according to Fin-Li-Da.

Table 7: Electroconductive indices of active facial points when the facial nerve has been cut.

Points	prior to procedure right	prior to procedure left	exposure 10 sec right	exposure 10 sec left	after procedure right	after procedure left
9	15	30	3	5	20	20
10	20	23	3	4	32	10
12	60	30	5	3	22	42
22	23	23	3	3	30	40
25	12	13	3	4	13	17
26	10	30	3	4	10	13

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the following articles are being translated by the Danish S.P.R. in Copenhagen and will be available shortly. They supplement the material in this monograph:

Beyasheva, Z.G., Bekmuhambetova, B.A.:"Investigation of the influence of red and white polarized light and the light of HeNe laser on EEG of man" Proceedings of the second thematic symposium of scientific practical papers on the problem of "Psychical Self Regulation",1974
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