Biophysical mechanisms of the therapeutic action of bioresonance therapy. Analysis and criticism of existing concepts

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In modern medicine, a physical method of treatment using natural electrical oscillations, electromagnetic fields and human radiation, which is known as bioresonance therapy, has become widespread.

Bioresonance therapy is based on empirical concepts, which were first expressed by the doctor F. Morell in 1977, and then, in the process of his joint work with the engineer Erich Rasche, were introduced into practical medicine as a method of treatment originally called MORA-therapy, derived from Morell-Rasche [1-3]. Subsequently, other terms began to be used: bioresonance therapy (BRT), bioresonance MORA therapy, biophysical information therapy (BIT), bioinformation therapy [4–6], including low-frequency electromagnetic stimulation [7]. At present, practically all of the above terms are used, despite the fact that they are based on the same hypothesis of F. Morel.

F. Morel considered the entire spectrum of electromagnetic fields and radiation, including the optical range, as a carrier of biologically significant information that can be used in treatment. In the BRT system developed by F. Morel, along with the patient's own electrical oscillations (endogenous BRT), treatment with external electromagnetic fields and radiation (exogenous BRT) was also used.

In 1992, on the basis of F. Morel's ideas, Brugemann GmbH (Germany) developed the BRT apparatus BICOM®, (derivative - from Biocommunication), and then - for multi-resonance therapy MULTICOM® [8, 9]. Currently, various versions and modifications of BICOM devices® manufactured by REGUMED Regulative Medizintechnik GmbH (Germany). The created equipment and method of treatment, based on the methodology postulated by F. Morel, have become very popular and have been successfully used in many countries for over 30 years.

In our country, the BRT method has become widespread and popular thanks to research and development carried out by the team of the Center for Intelligent Medical Systems "IMEDIS" under the leadership of Yu.V. Gotovsky. Formulated and developed by Yu.V. Gotovsky, the concept of endogenous adaptive BRT, which is based on a meridian, systemic approach to the treatment of various diseases, was implemented in the diagnostic and therapeutic equipment produced by the IMEDIS Center [10–12]. The mechanisms of the therapeutic action of BRT as a physical method of treatment using

electrical oscillations, electromagnetic fields and radiation of a certain frequency range can be considered from the standpoint of structural resonance therapy [13]. Together with the creation of diagnostic and therapeutic equipment by the team of the IMEDIS Center under the leadership of Yu.V. Gotovsky developed fundamentally new methodological approaches to the use of BRT in the treatment of various nosologies, including natural focal infections, in restorative medicine, as well as in laboratory studies aimed at experimental substantiation of the BRT method [14-16].

Currently, both in domestic and world literature, there are many published results on the successful use of BRT in the treatment of various diseases - from psychosomatic disorders to joint damage. There are also publications that reflect the results of laboratory, experimental and clinical and physiological studies of BRT performed under conditions using control groups.

However, since it is difficult to carry out control experiments, especially in a clinical setting, it is not surprising that there are a large number of publications in this area, the results of which are subject to well-founded criticism. At the same time, despite 30 years of experience of using in the world medical practice, the BRT method still does not have a fundamental scientific justification. This was the reason why critical articles began to appear recently, in which the BRT method is considered as pseudoscientific and suggestive and therefore not inherently therapeutic [17, 18]. At the same time, it should be noted that despite the long-term and effective use, many physical methods of treatment, which include BRT,

In this regard, it must be admitted that there is an urgent need to formulate and outline those probabilistic models and biophysical mechanisms of the therapeutic action of BRT, which, according to the authors, are currently the most acceptable and do not contradict the initial hypothesis, but are being actively discussed. [19, 20].

The BRT method is based on the concept of the human body as a source of electrical oscillations that exist on the surface of the body and in the surrounding space [1–4, 8, 9]. On the surface of the body, such vibrations (signals) are recorded in the form of electric potentials or currents, and at a certain distance - in the form of electromagnetic fields and radiation.

F. Morel postulated that in the recorded electrical oscillations, fields and radiation there are "physiological" (harmonious) and "pathological" (disharmonious) components. Physiological components have a sinusoidal or similar nature of the signal, while pathological ones differ from sinusoidal ones and therefore contain many harmonic components.

The processing of electrical vibrations entering the BRT apparatus can be carried out by inverting the pathological components and returning them to the patient. At the same time, the incoming electrical oscillations are filtered. Moreover, the process is continuous throughout the entire treatment period.

The episodic appearance in the scientific literature of critical remarks questioning the reality of the therapeutic effect of BRT is due to the lack of a scientifically substantiated and clinically acceptable concept of the mechanism of the therapeutic effect of BRT. The main provisions of this criticism, mainly from representatives of physical disciplines, boil down to the following: “bioresonance” does not exist in biological objects, it is a pseudoscientific term, the method itself is paramedical, and BRT is based on the placebo effect [17, 18, 21, 22]. In principle, such criticism is not something fundamentally new - in the collection published in 1971, Medical Occultism. Paramedicine "ed. O. Prokop, along with really antiscientific ones, were not always subject to well-grounded criticism and such currently recognized directions as homeopathy, iridology, the existence of anomalous zones on the surface of the Earth was denied, etc. [23].

At the same time, one cannot but admit that in the criticism of BRT, some provisions are very fair and appropriate, although some of them are essentially speculative and are expressed from a clearly non-constructive position.

First of all, this refers to the very term "biological resonance" or simply "bioresonance". In the classical physical sense, resonance (French resonance, from Latin resono - I sound in response, I respond) is a phenomenon of a sharp increase in the amplitude of forced oscillations in an oscillatory system, when the frequency of periodic influences on the system approaches its natural, resonant frequency [24]. Resonance is a well-known effect, and many physics textbooks give a classic example: the soldiers walked along the bridge "in step", and when the mechanical vibrations they created coincided in frequency with the natural vibrations of the bridge, it collapsed.

The resonance effect depends on the value of the fundamental (natural) frequency, the process of damping of oscillations and on the intensity of external influence. Natural (resonant) frequencies for the whole human body and its individual organs are established only for mechanical vibrations in the infrasonic and low-frequency sound region - from 2 to 400 Hz [25]. So, for example, for a seated person, the resonant frequency of mechanical vibrations is 4–6 Hz, in the abdominal cavity - 4–12 Hz, in the head - 8–27 Hz, eyes - 12–27 Hz, etc. In principle, mechanical resonance also exists for individual cells, for example, bacterial ones, which can be observed under conditionsin vitro [26].

Finding similar resonance frequencies for biological objects in the region of low-frequency alternating electrical oscillations, both experimentally and theoretically, is not only difficult, but also problematic. This is due to the large attenuation of electrical oscillations in biological media due to their high electrical conductivity. As a mechanical analogue, one can compare the oscillations of a pendulum in a viscous

(water) and free (air) environments - in the first case, its oscillations will be significantly weakened (damped) than in the second. The value inverse to the attenuation is the Q-factor, which must have a value of at least 100 to obtain a biologically significant resonance effect. Such a Q-factor in biological media cannot be observed due to purely physical limitations [28]. Since most devices for BRT, for example, BICOM®, operate in the range 10 Hz – 150 kHz [7], even with the presence of higher-frequency harmonics, at these frequencies the presence of such Q-factors in biological objects becomes unrealistic.

At the same time, the term "resonance" in the biophysics of electromagnetic fields and radiation at the macroscopic (organismic) level has long been used not in the classical physical sense - in this case, it means the maximum absorption of field energy at a certain frequency or in the frequency range [29]. This is due to the fact that the linear dimensions of the human body are comparable to the length of the incident electromagnetic wave with a frequency of the order of tens of MHz. In addition, there are maxima of absorption of the energy of the electromagnetic field both in individual parts of the human body (head, neck, arm, upper, lower limbs), and local areas inside them, for example, the head, which also have a resonant character.

However, all these processes of resonant absorption (in this sense) of the energy of the electromagnetic field occur at even higher frequencies - from hundreds of MHz to a few GHz. For example, resonant absorption of the electromagnetic field in the human head is observed at a frequency of 2.1 GHz [30].

Fundamentally different effects are observed at the microscopic (molecular) level [31]. In any biological object, there are free and bound charges that can move or orient themselves under the action of an external alternating electric field. In this case, two types of currents will flow in a biological object - conductivity and displacement. Conduction currents arise due to the movement of free charges in cells and tissues in the form of ions with a charge of macromolecules, etc. The emergence of displacement currents is due to the orientation of bound charges in the form of dipoles under the action of an external electric field. These processes of changing the position of charges in an electric field represent the polarization of a biological object.

No polarization is observed in the absence of an external electric field, since free molecules with a dipole moment are isotropically distributed in the medium. In all biological objects that are considered as dielectrics with losses, in general, there are two fundamentally different types of polarization: relaxation and resonance.

Relaxation polarization is determined by the inertia of the movement of charges in an alternating electric field and the time during which polarization occurs, i.e. moving a free charge or dipole from one position to another, which is the relaxation time. Relaxation polarization in biological media includes two main types - structural (macrostructural) and dipole polarizations.

Emergence structural polarization connected withlimitation movement of charges, as a result of inhomogeneities in the structures of biological objects within the same area. This restriction of the movement of, for example, extra- and intracellular ions due to the presence of membranes, is structural or macrostructural polarization.

Since the process of accumulation of charges itself is inertial, it is characterized by a certain relaxation time. If the relaxation time is close to or coincides with the frequency of the change in the external electric field, then the absorption of the field energy occurs, as a result of which a response occurs in the biological object.

Orientational polarization occurs as a result of the presence of molecules with a dipole moment in a biological object. Dipole moments are possessed by many molecules, including water molecules and, due to the dissociation of ionogenic groups and adsorption of ions, biological macromolecules, for example, protein molecules. Such molecules are rigid, i.e. a fixed dipole that also exists in the absence of an external electric field. The molecules possessing a dipole moment in the absence of an electric field are arranged randomly, and the magnitude of their oscillations is determined by the temperature of the medium. However, in an alternating electric field, a dipole molecule begins to vibrate around its axis and, as its frequency approaches the orientation (relaxation) time, it transforms into directional vibrational motion. The degree of orientation of the polar molecule decreases again with a further increase in the frequency of the electric field, and then a stage is reached when the molecule is no longer capable of orientation. In the region of those frequencies of the external electric field, when the forced vibrations of the dipole molecules are maximum, there is an absorption of the field energy and, as a consequence, a biological effect.

It should be especially noted that there are dipole moments that arise under the action of an external electric field and disappear in its absence. Such dipole moments are induced and determine the electronic and atomic polarization of molecules, which do not have a constant dipole moment [31]. Electronic polarization in molecules or ions occurs as a result of the displacement of electronic orbits relative to charged nuclei. Atomic polarization is mainly observed in crystals with an ionic bond between atoms, when ions are displaced in an external electric field in the crystal lattice. With these types of polarization, molecules, ions or atoms become dipoles only in an electric field, and in its absence they are not. This polarization is characterized by resonance interactions,

Thus, there are several types of polarization: structural (macrostructural), dipole (orientational), electronic and atomic (ionic displacement), which are based on different mechanisms. So, the electronic and atomic are related to the resonance, and the structural and dipole surface - to the relaxation form of polarization.

In this regard, the nature of the frequency dependences for the listed species

polarizations (structural, orientational, atomic and electronic) are significantly different. Relaxation-type interactions are observed in low-frequency regions of the electromagnetic spectrum, while resonance interactions occurring at electronic polarization are characterized by maxima in the IR, visible, and UV regions, i.e. where the resonant frequencies are. A similar resonance mechanism for BRT, based on the biophotonic concept of F.A. Pop (FA Popp) [32], was proposed by M. Galle [33], however, this type of interaction is more typical for methods of color light therapy and light puncture, where radiation is used, the frequencies of which are located in these regions of the electromagnetic spectrum [34].

However, in physiotherapy, the method of microwave resonance (MRI therapy) or extremely high-frequency (EHF-therapy) therapy is widely used, including with local exposure to points and areas of the skin (EHF-puncture), in which treatment is carried out by exposure in the millimeter range electromagnetic wavelengths - from 10 to 1 mm (30–300 GHz) [35, 36]. When substantiating this method, as a rule, one proceeds from the curves of the dependences of the detected reactions of a biological object on the frequency, which, on the basis of their shape, are interpreted as resonant. It should be noted that most of these "resonance" dependences were obtained under the conditionsin vitro, on individual cells or cellularcultures [37, 38].

Transferring the mechanisms of such effects from conditions in vitro onthe organismic level has always been and is a source of serious errors. In the context of all of the above, the following very indicative quote should be cited: “The interaction of radiation with biological objects is usually frequency-dependent, and these dependencies are well reproduced. The frequency dependence of the interaction effect resembles the resonancecharacteristic of the oscillating circuit. By analogy with this, one usually speaks of resonant interaction effects ”[39, p. 5]. If we follow this principle, then we can quite rightly consider mono and polymodal dependences obtained for the intensity-effect or dose-effect dependences under the influence of physical factors of low and ultra-low intensities or for substances whose action is manifested in concentrations of similar orders [40]. It is noteworthy that W.R. Ady (WR Adey), who discovered and confirmed in his further studies the presence of frequency and energy "windows" in the biological action of low-frequency electric and electromagnetic fields in the range from 0.5 to 25 Hz with a maximum at 16 Hz, has never considered the results obtained. from resonant positions, knowing full well that in this frequency range they are simply not feasible [41]. On the other side,in vitro, when the frequency of the external electromagnetic field coincides oris close to the natural vibrations of a molecule or to the collective vibrations of its individual subunits, domains, etc. [42]. However, at the organismal level, such interactions as biological effects are difficult, if not impossible, to trace and identify.

A completely different meaning is put into the concept of coincidence of the frequencies of the bioelectric activity of certain organs or tissues (heart, brain, nervous or muscle tissue) with the frequency of the acting external low-frequency electric or magnetic fields, such as the spectrum of natural Schumann frequencies with the spectral composition of the EEG [43]. It is quite possible that such a frequency or frequencies, determined experimentally or obtained by calculations, have any effect when exposed to the human body, and not necessarily only positive (therapeutic). Such frequencies can be biologically effective and, when exposed, cause a response from both the whole organism and its individual functional systems, but this is not directly related to resonance phenomena [44]. Thus, It can be summarized that all the above-described processes associated with resonances are such by the nature of the recorded biological reaction, and not by the mechanism of interaction. So, in this case, the remarks about the illegality of the applicability of the term "bioresonance" to the above-described processes and phenomena should be recognized as fair, including a certain physical incorrectness in the use of the term itself.

The current situation, apparently, should be considered as a discrepancy in the terminology used, since the phenomenon of resonance in the classical physical understanding with BRT is not observed, however, it would be wrong to unequivocally reject the term “bioresonance” that has been formed and used for a long time. Moreover, as will be shown in the following publications, the application of the principles of nonlinear dynamics to the analysis of the mechanisms of the therapeutic action of BRT allows considering biological resonance from completely different, clearly substantiated biophysical positions.

Literature

1. Morell F. Die MORA-Therapie - Therapie mit korpereigenen Schwingungen. - Friesenheim, Med-Tronic, 1978.

2. Morell F. MORA-Therapie, Patienteneigene und Farblichtschwingungen Konzept und Praxis. - Heidelberg, Karl F. Haug-Verlag, 1987.

3. Rasche E. MORA, Einstieg in die elektronische Homeopathie Selbstverlag. - Med-Tronic, 1989.

4. Brugemann H. Bioresonanztherapie. Grundlagen und Praxis der weiterentwickelten Therapie mit patienteneigenen Schwingungen nach Morell // Erfahrungsheilkunde. - 1989. - Bd. 38, H. 3a. - S. 162-167.

5. Wille A. Bioresonanztherapie (biophysikalische Informationstherapie) bei stotternden Kindern // Forsch. Komlementarmed. - 1999. - V. 6, Suppl. 1. - P. 50–52.

6. Ludwig W. Messtechnische Möglichkeiten und Grenzen, um die BIT beweisbar zu machen // Erfahrugsheilkunde. - 2001. - Bd. 50, H. 7. - S. 406-408.

7. Fedorowski A., Steciwko A., Rabczynski J. Influence of low-frequency electromagnetic field generated by transformation of endogenous Morris hepatoma field on its growth and metastatic ability (I) // Med. Sci. Monit. - 1997. - V. 3, N. 3. - P. 336–341.

8. Brugemann H. Bioresonanztherapie. Grundlagen und Praxis der

weiterentwickelten Therapie mit patienteneigenen Schwingungen nach Dr. Morell // Erfahrungsheilkunde. - 1991. - Bd. 40, H. 10. - S. 674-677.

9. Brugemann H. Bioresonanzund MultifrequenzTherapie (BRT) Neue, zukunftsweisende Therapieformen mit ultrafeinen Korperenergien und Umweltsignalen. Eine Dokumentation zur Theorie und Praxis. - Heidelberg, Karl F. Haug Verl., 1992.

10. Gotovsky Yu.V. Bioresonance and multiresonance therapy // Mater. I International conf. "Theoretical and clinical aspects of bioresonance and multiresonance therapy." - M .: IMEDIS, 1995. - S. 359–367.

11. Gotovsky Yu.V. Results and prospects for the development of bioresonance and multiresonance therapy // Abstracts. and reports. III Int. conf. "Theoretical and clinical aspects of bioresonance and multiresonance therapy." - M .: IMEDIS, 1997. - S. 12-29.

12. Meizerov E.E., Blinkov I.L., Gotovsky Yu.V., Koroleva M.V., Katorgin V.S. Bioresonance therapy. Methodical recommendations No. 2000/74. - M .: Scientific-practical. center of trad. honey. and homeopathy of the Ministry of Health of the Russian Federation, 2000.

13. Blinkov I.L., Gotovsky Yu.V. Structural resonance therapy (Exogenous bioresonance therapy). - M .: IMEDIS, 1998.

14. Chernetsova L.V., Gotovsky Yu.V., Ryabov V.I., Borodina Zh.I., ... Kamenshchikova T.M. Ways to improve the diagnosis and treatment of natural focal infections in Udmurtia // Tez. and reports. VII Int. conf. "Theoretical and clinical aspects of bioresonance and multiresonance therapy." - M .: IMEDIS, 2001. - Part I. - S. 3-16.

15. Chernetsova L.V. Bioresonance therapy as an option for physical lymphosanation in the complex treatment of hemorrhagic fever with renal syndrome // Mater. Privolzhsk. scientific-practical conf. Endoecological Medicine. New directions in treatment, health improvement, prevention ”. - N. Novgorod-Moscow, 2003. - S. 61–62.

16. Kudinova E.V., Stepanov S.S. Changes in the angioarchitectonics of the hippocampus white rats in experimental stress syndrome and their correction by the method of bioresonance therapy // Omsk Scientific Bulletin. - 2003. - Issue. 24. - pp. 110–112.

17. Ernst E. Bioresonance: a study of pseudoscientific language // Forsch. Komlementarmed. - 2004. - V.11, N. 3. - P. 171-173.

18. Wuthrich B., Frei PC, Bircher A., Hauser C., Pichler W., Schmid-Grendelmeierf P., Spertini F., Olgiati D., Muller U. Bioresonanz - diagnostischer und therapeutischer Unsinn. Stellungnahme der Fachkommission der Schweizerischen Gesellschaft fur Allergologie und Immunologie (SGAI) zu den Bioresonanzund Elektroakupunkturgeräten zur Diagnostik und Therapie von (vermeintlichen) Allergien. // Schweiz. Arztezeitung. - 2006. - Jr. 87, N. 2. - S. 50-54.

19. Koler B. Biophysikalische InformationsTherapie - Mystik oder Physik? // Erfahrugsheilkunde. - 1997. - Bd. 46, H. 4. - S. 210-214.

20. Scott-Morley E. Is bioresonance diagnostics and therapy scientific? // Abstracts. and reports. VIII Int. conf. "Theoretical and clinical aspects of bioresonance and multiresonance therapy." - M .: IMEDIS, 2002. - Part II. - S. 321–333.

21. Cap F. Bemerkungen eines Physicers zur Bioresonanz // Allergologie. - 1995. -

Jr. 18, N. 6. - S. 253-257.

22. Wuthrich B., Frei PC, Bircher A., Hauser C., Pichler W., Schmid-Grendelmeier P., Spertini F., Olgiati D., Muller U. Bioresonanz diagnostischer und therapeutischer Unsinn // Akt. Dermatol. - 2006. - Bd. 32, N. - S.73-77.

23. Medical occultism. Paramedicine / Ed. O. Prokop. - M .: Medicine, 1971.

24. Resonance / Electronics. Encyclopedic Dictionary. - M .: Soviet encyclopedia, 1991. - pp. 471–472.

25. Frolov K.V., Goncharevich I.F., Likhnov P.P. Infrasound, vibration, human. - M .: Mechanical Engineering, 1996.

26. Zinin PV, Allen JC, Levin VM Mechanical resonances of bacterial cells // Phys. Rev. E. - 2005. - V. 72, N. 6, pt. 1. - P. 061907.

27. Chernavsky D.S., Chernavskaya N.M. "Belokmashina". Biological macromolecular structures. - M .: Janus-K, 1999.

28. Derney K.H. Human and animal models applied to Electromagnetic Dosimetry: Review of Analytical and Numerical Methods // TIIER. - 1980. - T. 68, No. 1. - S. 40–48.

29. Joines WT, Spiegel RJ Resonance absorption of microwaves by the human skull // IEEE Trans. Microwave Theory Tech. - 1974. - V.22, N. 1. - P. 46–48.

30. Schwan HP Biophysics of the interaction of electromagnetic energy with cells and membranes // Biological Effects and Dosimetry of Nonionizing Radiation. Radiofrequency and Microwave Energy / NATO ASI ser. Ser. A. - Plenum Press, New York, London, 1983. - V. 49. - P. 213-231.

31. Hippel A.R. Dielectrics and waves. - M .: Publishing house Foreign Literature, 1960.

32. Popp FA Some essential questions on biophoton research and probable answers // Recent Advances in Biophoton Research and its Applications / Popp FA, Li KH, and Gu Q. eds. - Singapore: World Scientific, 1992. - P.1-46.

33. Galle M. Biophotonen und MORABioresonanz. Eine theoretische Annaherung // Erfahrugsheilkunde. - 2005. - Bd.54, H.5. - S. 293-300.

34. Gotovsky Yu.V., Vysheslavtsev A.P., Kosareva L.B., Perov Yu.F., Shraibman M.M. Color light therapy. - M .: IMEDIS, 2001.

35. Sevastyanova L.A., Borodkina A.G., Zubenkova E.S. Resonant character impact of millimeter-wave radio waves on biological systems // Effects of non-thermal effects of millimeter radiation on biological systems. - M., 1983. - S. 34–47.

36. Andreev E.A., Bely M.U., Kutsenyuk V.A., Livenets L.S., Pyasetsky V.I., Sitko S.P., Skopyuk M.I., Talko I.I., Yudin V.A. Physical foundations of microwave (bioresonance) correction of the physiological state of the human body // Application of low-intensity millimeter radiation in biology and medicine. - M., 1985. - S. 58–83.

37. Ponomarenko G.N., Vorobiev M.G. Physiotherapy Guide. - SPb .: IIC "Baltika", 2005.

38. Teppone M.V. Multi-zone EHF-therapy or EHF-puncture. - M .: Koloyaro, 1997.

39. Betsky OV, Devyatkov ND, Kislov V.V. Millimeter waves low intensity in medicine and biology // Biomedical Radioelectronics. - 1996. - No. 12. - P. 3–15.

40. Betsky OV, Kislov V.V., Lebedeva N.N. Millimeter waves and live systems. - M .: SAYENS-PRESS, 2004.

41. Gotovsky Yu.V., Perov Yu.F. Features of biological action physical and chemical factors of low and ultra-low intensities and doses. - M .: IMEDIS, 2003.

42. Adie W.R. Frequency and energy windows when exposed to weak electromagnetic fields on living tissue // TIIER. - 1980. - T. 68, No. 1. - S. 140-148.

43. Kenny J. Resonances of interest: EEG and ELF // Speculations in Science and Technology. - 1991. - V. 15, N. 1. - P. 50–53.

44. Khabarova O.V. Bioeffective frequencies and their relationship with eigenfrequencies frequencies of living organisms // Biomedical technologies and radioelectronics. - 2002. - No. 5. - P. 56–66.

Gotovsky, M.Yu. Biophysical mechanisms of the therapeutic action of bioresonance therapy. Analysis and criticism of existing concepts / M.Yu. Gotovsky, Yu.F. Perov, L.V. Chernetsova // Traditional Medicine. - 2007. - No. 4 (11). - P.34-40.

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