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“BIOELECTRONIC MEDICINE”: basic definitions and practical significanceG. V. Nevoit^{1,*}, K. Poderiene², S. I. Danylchenko³, M. M. Potyazhenko⁴, O. P. Mintser⁵, G. Jarusevicius⁶, A. Vainoras^{7*}¹Laboratory for Automatization of Cardiovascular Investigations, Cardiology Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania²Department of Health and Rehabilitation, Lithuanian Sports University Institute of Sports Science and Innovation, Kaunas, Lithuania³Department of Physical Therapy, Occupational Therapy, Kherson State University, Ivano-Frankivsk region, Ukraine⁴Department of Internal Medicine and Emergency Medicine, Poltava State Medical University, Poltava, Ukraine⁵Department of Fundamental Disciplines and Informatics, Shupyk National Healthcare University of Ukraine, Kyiv, Ukraine⁶Laboratory for Automatization of Cardiovascular Investigations, Cardiology Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania⁷Laboratory for Automatization of Cardiovascular Investigations, Cardiology Institute, Lithuanian University of Health Sciences, Kaunas, LithuaniaORCID: [0000-0002-1055-7844](https://orcid.org/0000-0002-1055-7844), e-mail: ganna.nevoit@lsmu.ltORCID: [0009-0000-4151-0742](https://orcid.org/0009-0000-4151-0742), e-mail: kristina.poderiene@lsu.ltORCID: [0000-0001-5312-0231](https://orcid.org/0000-0001-5312-0231), e-mail: svetlanaadanilch@gmail.comORCID: [0000-0001-9398-1378](https://orcid.org/0000-0001-9398-1378), e-mail: m.potiazhenko@pdmu.edu.uaORCID: [0000-0002-7224-4886](https://orcid.org/0000-0002-7224-4886), e-mail: omintser@gmail.comORCID: [0000-0001-9205-1902](https://orcid.org/0000-0001-9205-1902), e-mail: gediminas.jarusevicius@lsmu.ltORCID: [0000-0002-5732-8520](https://orcid.org/0000-0002-5732-8520), e-mail: alfonsas.vainoras@lsmu.lt***Correspondence:** ganna.nevoit@lsmu.lt (G.V. Nevoit); alfonsas.vainoras@lsmu.lt (A.Vainoras)

Abstract. This is a review of the first lecture in the “Bioelectronic Medicine or Look at Medicine Differently” series, which presents and substantiates its key concepts, meanings, and relevance. This is an educational and scientific project for the further progress of medicine and its quantum fields. The goal is the scientific development and popularization of the Magneto electrochemical Theory of Metabolism and Life, which unites existing medical knowledge with modern biophysical understanding of the organization and functioning of the human body at the nanoscale and deeper.

Medicine is a transdisciplinary branch of scientific knowledge that, in modern conditions, develops through the acquisition of fundamental knowledge from other fields. It is important to note that today, at the start of the 21st century, unique conditions have emerged that allow modern scientists to continue making breakthroughs in medicine. This includes the emergence of a large amount of fundamentally new knowledge, obtained through the research of physicists and biophysicists.

This knowledge continues to be integrated into medicine, but slowly and in complex ways. There are several reasons for this. First, modern science continues to experience an information boom: the number of scientific publications is so vast that a single scientist's lifetime would not be enough to familiarize themselves with them. Second, the development of new transdisciplinary knowledge is significantly complicated by the use of specific terminology, which can be difficult for scientists in the biological and medical fields to understand. Consequently, transdisciplinary gaps between fields are emerging in science.

An example of this is the existing transdisciplinary scientific gap between quantum physics and medicine. Third, complex, lengthy work in systems analysis and the rethinking of existing knowledge is necessary to create a modern, universal paradigm. This requires scientific specialists with the appropriate professional competencies in related fields. Technical conditions for their work and funding for such research are also necessary, and so on.

“A journey of a thousand miles begins with a single step.” Therefore, this publication opens a series of reviews devoted to the development of systems medical knowledge and aimed at integrating existing discoveries in physics/bio-

physics into the medical scientific paradigm. The goal of this review is to present the scientific basis for the promising transdisciplinary scientific field of “Bioelectronic Medicine.”

Conclusions: 1) A new layer of fundamental knowledge in quantum physics has formed a promising new transdisciplinary scientific field – “Bioelectronic Medicine.” This is the latest trend in the development of medical science and education that modern medical scientists must pursue. 2) The Magneto electrochemical Theory of Metabolism and Life is a biological theory that adapts knowledge of quantum physics to medical needs and serves as the theoretical basis for the further practical implementation of quantum medicine in educational and scientific medical fields. 3) The educational, scientific, and practical project “Bioelectronic Medicine” is a promising new “tool” for further developing the latest scientific medical perspective in medical students and doctors, as a guarantee of future progress in the medical field.

Keywords: medicine, bioelectronic medicine, quantum medicine, magneto-electrochemical theory of metabolism and life, new paradigm, biophysics.

Introduction. By the end of the first quarter of the 21st century, medicine as a scientific field had undoubtedly achieved significant achievements [1, 2]. However, many medical problems related to the diagnosis and treatment of chronic diseases of human internal organs remain unresolved [3, 4]. Therefore, the further development of medicine and the search for new avenues for its progress remain relevant.

Medicine is a transdisciplinary branch of scientific knowledge that, in modern conditions, develops through the acquisition of fundamental knowledge from other fields [5]. It is important to note that today, at the start of the 21st century, unique conditions have emerged that allow modern scientists to continue making breakthroughs in medicine. This includes the emergence of a large amount of fundamentally new knowledge, obtained through the research of physicists and biophysicists [6-9]. Breakthroughs in understanding the subatomic structure of matter and the rapid development of information technology have provided a significant basis for fundamental knowledge about the role of electromagnetic processes in the functioning of living organisms and humans [10-14].

This knowledge continues to be integrated into medicine, but slowly and in complex ways. There are several reasons for this. First, modern science continues to experience an information boom: the number of scientific publications is so vast that a single scientist's lifetime would not be enough to familiarize themselves with them [15]. Second, the development of new transdisciplinary knowledge is significantly complicated by the use of specific terminology, which can be difficult for scientists in the biological and medical fields to understand. Consequently, transdisciplinary gaps between fields are emerging in science.

An example of this is the existing transdisciplinary scientific gap between quantum physics and medicine. Third, complex, lengthy work in systems analysis and the rethinking of existing knowledge is necessary to create a modern, universal paradigm. This requires scientific specialists with the appropriate professional competencies in related fields. Technical conditions for their work and funding for such research are also necessary, and so on.

“A journey of a thousand miles begins with a single step.” Therefore, this publication opens a series of reviews devoted to the development of systems medical knowledge and aimed at integrating existing discoveries in physics/biophysics into the medical scientific paradigm.

The goal of this review is to present the scientific basis for the promising transdisciplinary scientific field of “Bioelectronic Medicine.”

Materials and methods. This scientific material is a fragment of a research work from the Department of Internal Medicine and Emergency Medicine of Poltava State Medical University (23 Shevchenko St., 36011, Poltava, Ukraine) on “Development of algorithms and technologies for implementing a healthy lifestyle in patients with non-communicable diseases based on the study of functional status” (state registration number 0121U108237: UDC 613 616-056-06: 616.1/9-03). It is the result of a systematic analysis of literature data.

Biophysical models and scientific data theorized by physicists and published in the specialized literature were analyzed. General scientific methods (dismemberment and integration of elements of the studied system, imaginary experiment, logical and historical research, analysis, induction, deduction, and synthesis of knowledge) and theoretical methods (method of constructing theory, logical methods, and rules of normative nature) were used in this theoretical study. Scientific work is carried out in conjunction with the following scientific institutions: 1) Lithuanian University of Health Sciences (9, A. Mickevičius St., LT-44307, Kaunas, Lithuania), the cooperation coordinator is Prof., DM A. Vainoras; 2) Shupyk National Healthcare University of Ukraine (9, Dorogozhytska St., 04112, Kiev, Ukraine), the cooperation coordinator is Prof., DM O.P.Mintser; 3) Kherson State University (14, Shevchenka St, Ivano-Frankivsk, 76000, Ivano-Frankivsk region, Ukraine), the cooperation coordinator is As. Prof., PhD S. Danylchenko; 4) Lithuanian Sports University Institute of Sports Science and Innovation (6, Sporto St, LT-44221 Kaunas, Lithuania), the cooperation coordinator is As. Prof., PhD K. Poderiene.

The practical application of the obtained results in medical science is carried out through a series of lectures within the educational-scientific initiative “Bioelectronic Medicine or Look at Medicine Differently” [16].

Results. A logical rethinking and extrapolation of existing biophysical data to the human body led to the creation of a universal biological theory of the role of electromagnetic processes in the formation of the human body's structure, metabolism, and life. It was called the Magneto electrochemical Theory of Metabolism and Life/Health. This theoretical study began in 2018. In 2021, the

first volume of the monograph [17] was published, which conceptualized the role of electromagnetic processes at the subatomic, atomic, molecular, subcellular, and cellular

levels. This book received positive feedback from leading scientists in Ukraine [18-20] (Figure 1).



Figure 1. Title pages of the monograph and reviews thereof. An excerpt from [17-20] is used.

The obtained results demonstrated the existence of a significant body of biophysical knowledge that has not been fully integrated into medical science [21]. This modern biophysical fundamental knowledge possesses signifi-

cant paradigm-transforming potential for medical science [21, 22]. The concept of quantum energy levels in the structure of matter [23-25] forms the theoretical basis for the idea of Bioelectronic Medicine (Figure 2).

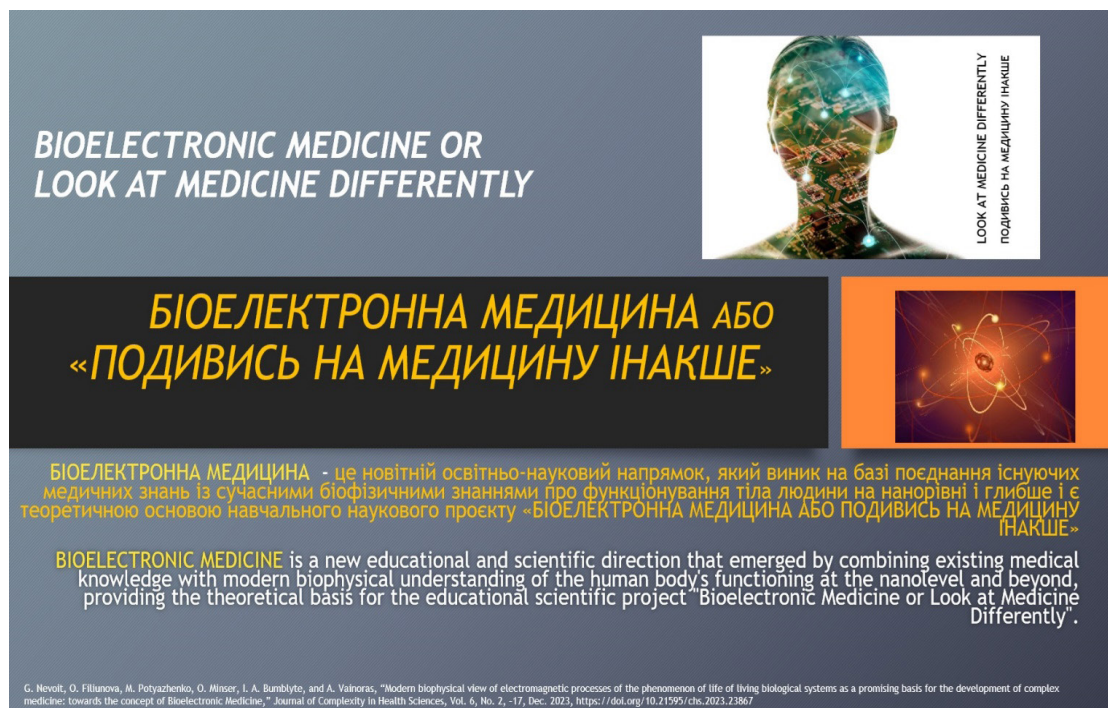


Figure 2. The concept of Bioelectronic Medicine as the basis of the scientific educational project “Bioelectronic Medicine or Look at Medicine Differently.”

Quantum energy levels of the structure of matter as a theoretical basis for Bioelectronic Medicine

Advances in physics, particularly in quantum physics, have fundamentally changed and deepened our understanding of matter. The discovery and development of the Standard Model provided the theoretical basis for substantiating the existence of subatomic levels [23-25]. At subatomic levels, matter is represented in a state of energy

in its various manifestations. According to the Standard Model, atomic components such as the nucleus and electrons are divisible and consist of quarks [23-25]. Quarks are electromagnetic field structures or, in other words, energy [23-25]. Therefore, the structure of the human body can now be correctly represented using such models (Figure 3).

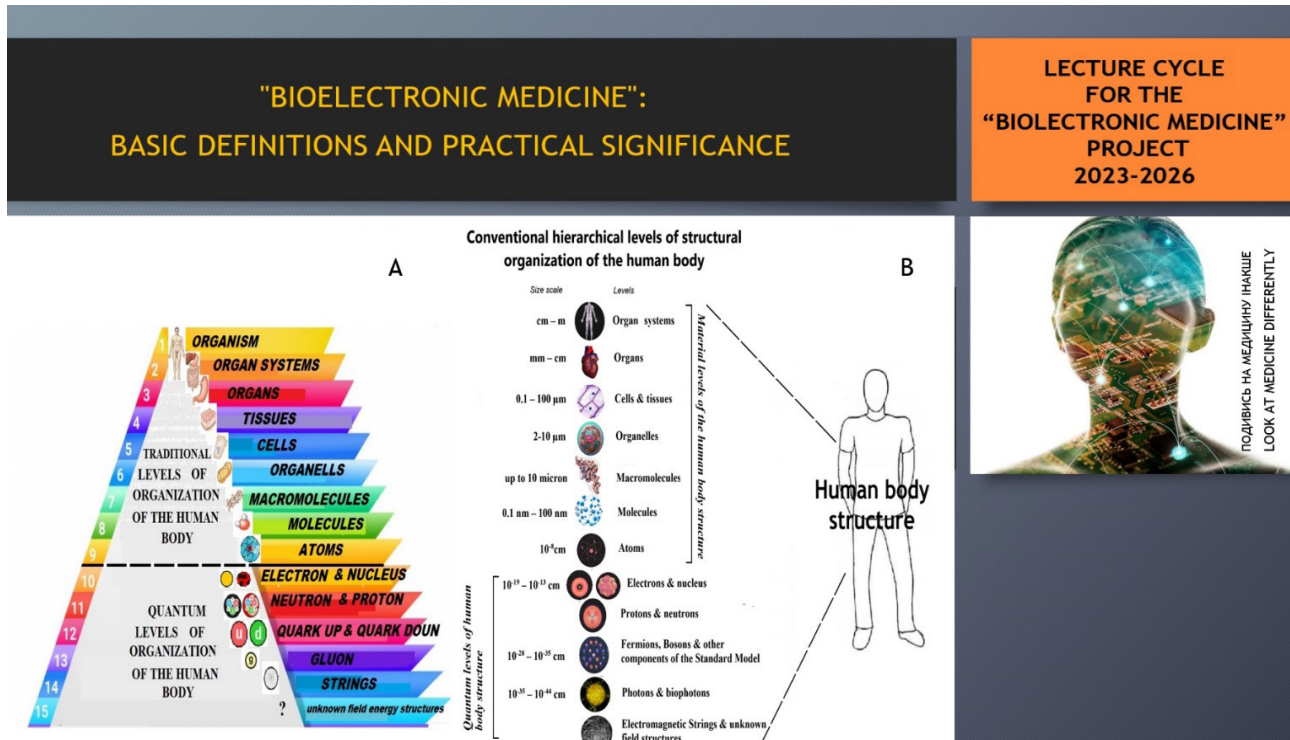


Figure 3. Hierarchical levels of the human body structure. A is a fragment of the figure from [26]; B is a fragment of the figure from [27].

Science now knows that where the material level of atoms ends, the energy level of the structure of matter begins. This is also called the quantum level [26]. In simple terms, this can be described as follows.

If we imagine ourselves delving into the depths of matter, we first see the familiar atomic lattices of matter. Then, after reducing the scale to a level of 10^{-9} – 10^{-13} cm, we see that there are no atoms in matter, but only the energy of the motion of electromagnetic waves in the internal environment. At this “depth,” the atomic nucleus is an electromagnetic phenomenon, conventionally represented as a rotating electromagnetic rod composed of protons and neutrons [26].

Protons and neutrons are magnetic waves moving at the speed of light along a spiral-ring trajectory. Further reduction of the scale to 10^{-28} – 10^{-35} cm corresponds to the description of bosons as rings of wave processes, linked by magnetic and other interactions into ordered structures that occur at a velocity 10^6 times the speed of light, and so on. Therefore, all atoms and molecules at the microscopic level of their structure are an organized form of electromagnetic energy. All interactions between atoms and molecules in cells also occur due to electromagnetic energy. The human body, at the subatomic level, is organized ener-

gy and a complex conglomerate of electromagnetic waves/wave processes [26]. The traditional model for describing the hierarchical levels of the human body’s structure must be supplemented in line with the updated paradigm (Figure 4).

Thus, modern fundamental understanding of the structure of matter at the microlevel significantly broadens scientific views of the structure of the human body and extends the boundaries for further scientific understanding of its fundamental aspects of functioning. A detailed justification and description of the organization of the quantum levels of the human body and their significance from the perspective of systems biology and systems medicine were provided in the Magneto electrochemical Theory of Metabolism and Life [17, 28-31].

The Magneto electrochemical Theory of Metabolism and Life is a biological theory that, for the first time, extrapolated and combined existing knowledge of physics with biological knowledge. On the one hand, this allowed the creation of a unified, logical vision of the role of electromagnetic processes in metabolism and in the phenomena of biological life in living organisms and humans. On the other hand, the Magneto electrochemical Theory of Metabolism and Life applied physical knowledge to bio-

logical understanding.

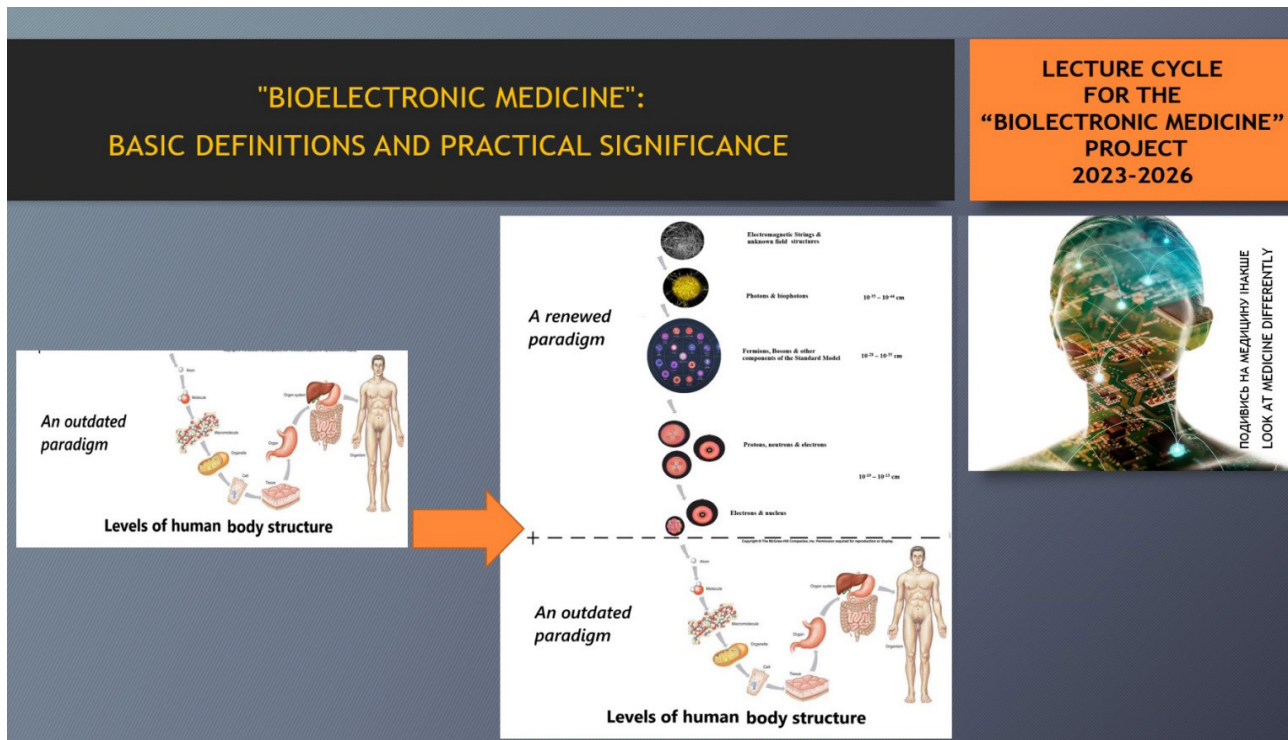


Figure 4. Supplementing the traditional model of the hierarchical structure of the human body according to the knowledge of the updated paradigm.

It resolved the paradox of the interdisciplinary gap between physicists and specialists in biology and medicine in modern science. The Standard Model entered the paradigm of knowledge in the mid-20th century [23-25], but only now is its integration into concepts of the hierarchical levels of human body structure occurring.

Bioelectronic medicine and its diagnostic capabilities.

It is well known that, in our civilization, medical science began by studying the human body at the material level. The structure and functions of organs, tissues, cells, and molecules were studied. Today, the situation has changed, and opportunities have opened up for obtaining diagnostic data from the energetic/quantum level of matter. A new branch of medicine has emerged that relies on quantum-level diagnostic parameters and directs therapeutic interventions accordingly (Figure 3). It is known by various names: quantum medicine, bioelectronic medicine, and energy medicine [26]. Understanding this represents significant scientific progress in the 21st century compared to that of previous centuries.

The term “Bioelectronic Medicine” arose from the understanding that, at the microscopic level of organization in living organisms, electrons serve as energy carriers and participate in all in vivo metabolic transformations of molecules [26]. This term is neither exhaustive nor the most appropriate because the elementary energy carriers of the electromagnetic field are biophotons, and energy can be represented in various forms: electrons, excitons, neutrons, positrons, and so on. For this reason, synony-

mous terms such as “Quantum Medicine,” “Biophotonic Medicine,” and “Energy Medicine” exist in science. Scientists will determine which term is more precise in future research. Currently, there is a practical need to standardize terminology in this developing scientific field. Therefore, the use of the term “Bioelectronic Medicine” is justified. This term is understood by a wide range of scientists from various biomedical fields and has been actively used for several years [26].

Bioelectronic medicine is a scientific field based on the assessment of the frequency-wave parameters of atoms and subatomic structures as objectively existing biological phenomena [16]. any existing diagnostic methods in medicine can be classified as bioelectronic medicine techniques, either fully or partially. Examples include such commonly used methods as nuclear magnetic resonance, heart rate variability studies, magnetocardiography, and magnetoencephalography. Long-established methods such as the Vega test and gas-discharge visualization/electrophoton emission analysis can also be classified as bioelectronic medicine methods.

For example, nuclear magnetic resonance is precisely such a method. The essence of this method is the application of a powerful electromagnetic field to the entire human body (Figure 6). This is done to influence the precession/oscillation of each atomic nucleus in the human body’s structure and elicit a resonant response from it. The human body contains the most significant amounts of hydrogen (1H), carbon (13C), sodium (23Na), and phosphorus (31P) nuclei. In the absence of an external field, the

spins and magnetic moments of protons are randomly oriented (central part of Figure 4, left). If a proton is placed in an external magnetic field, its magnetic moment will either be co-directional or counter-directional with the magnetic field (central part of Figure 6, right). In the latter case, its

energy will be higher. The sum of these resonances graphically determines the composition of a particular area of the human body [32, 33].

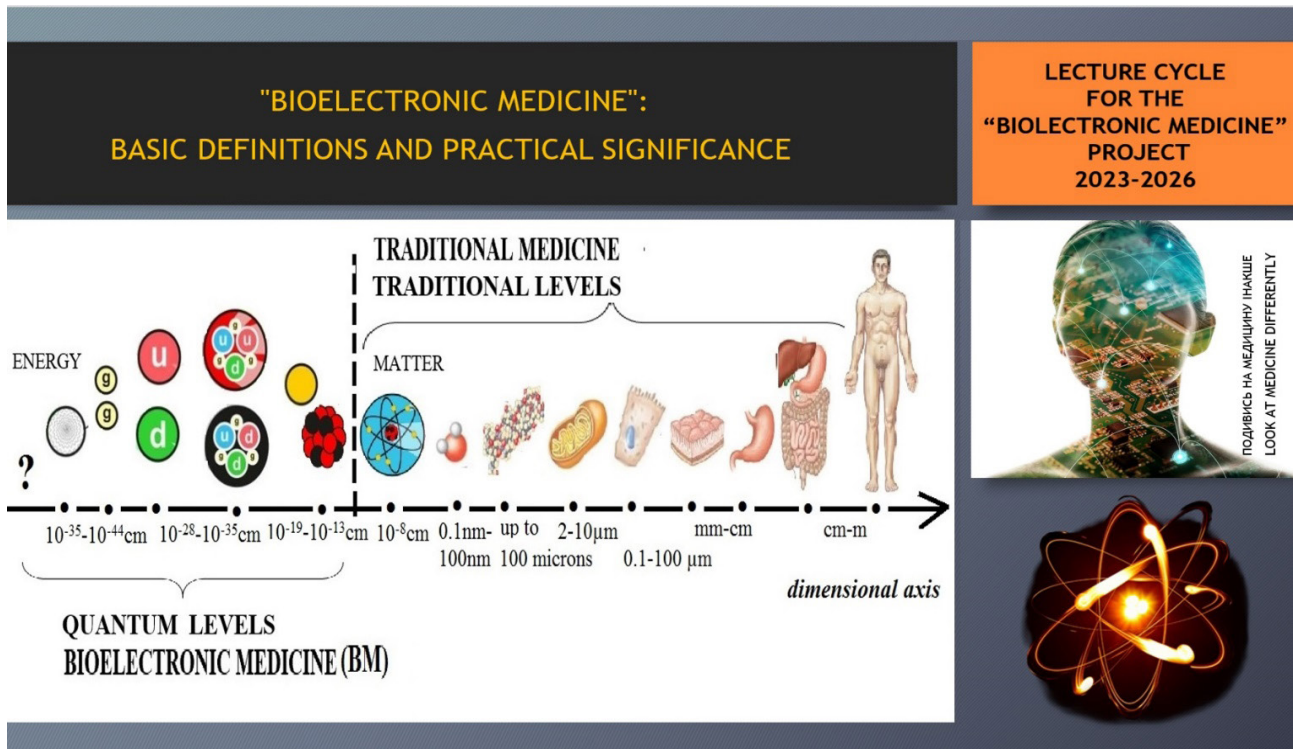


Figure 5. Hierarchical levels of structure are studied by Medicine and Bioelectronic Medicine [26].

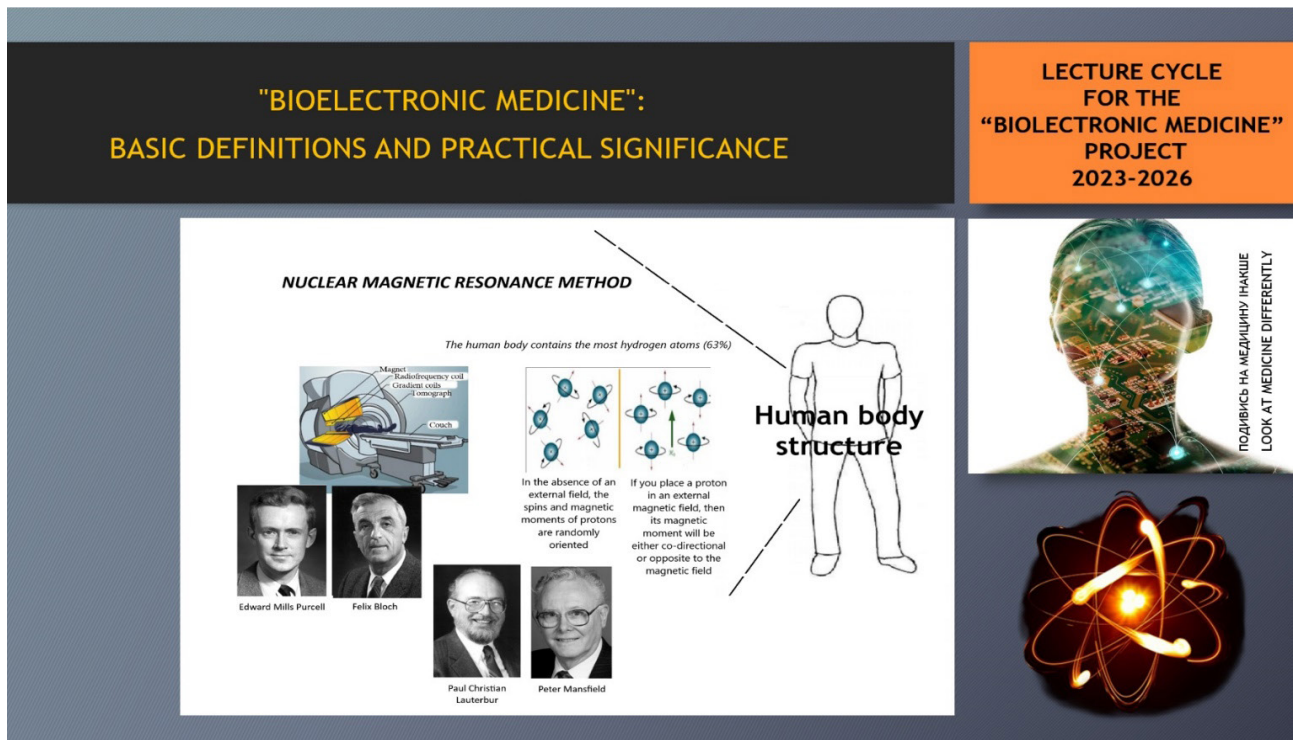


Figure 6. Nuclear magnetic resonance is a method of bioelectronic medicine.

In 1952, Felix Bloch and Edward Purcell (USA) received the Nobel Prize in Physics for their discovery of nuclear magnetic resonance. In 2003, Paul Lauterbur (USA) and Peter Mansfield (UK) received the Nobel Prize in Physiology or Medicine for developing magnetic resonance imaging, a diagnostic method [33].

Advances in physics ushered in an era of understanding that energy can carry information [34-38]. On the one hand, this ushered in the era of information technology, mobile communications, and so on. On the other hand, it became clear that the energetic/electromagnetic processes of metabolism and vital functions of the human body are related to systemic information processes [17]. Along with chemical communication, electromagnetic communication occurs between cells, tissues, and organs *in vivo* [39-41]. This is the key biophysical mechanism of instantaneous functional communication within and between cells. Electromagnetic communication creates a common electromagnetic/quantum field of cells *in vivo* [17]. The electromagnetic fields of all cells in a biological organism merge to form the electromagnetic fields of organs and the entire organism [17]. This is the basis of cell morphogenesis during the development of the organism and the basis of the phenomenon of life in general [17]. The cessation of electromagnetic generation of cells is the onset of their biological death [17]. This is a long-established and well-known fact. For example, electrographic recording of the absence of electromagnetic generation by brain cells is used to confirm brain death [42]. Recording an isoline on an electrocardiogram is an objective criterion for establishing the clinical and biological death of the human organism [43].

There are certified methods and measuring equipment that allow indirect *in vivo* measurement of electromagnetic processes in human cells. A classic, widely known method is electrography, particularly electrocardiography. In the classic sense, cardiography is based on the analysis of the graphical display of differences in electrical potentials on the human body's skin, generated by the myocardium [44]. However, the use of modern, computerized instrumental methods for analyzing the electromagnetic parameters of heart rhythm enables evaluation of the information components of the heart's electromagnetic processes and pulse [45]. A method for assessing heart rate variability is of essential and promising significance [46-49]. In other words, specialized equipment enables evaluation of the fundamental electromagnetic parameters generated by myocardial cells. Evaluation of their relationships enables an objective assessment of the functional state of the human body [50-53]. For example, it allows evaluation of the risk of sudden cardiac death. The electrocardiograms of patients with stable hemodynamics who will die in the near future may not show fundamental visual differences from those of other patients. However, comparing spectral frequency analysis parameters from short heart rate variability recordings reveals a significant decrease in Total Power and an imbalance in spectral components. This reflects the fact that in these patients, myocardial cells weakly generate an electromagnetic field, and this field already ex-

hibits significant qualitative changes in its frequency-wave composition. This is a symptom of the progression of electromagnetic failure of myocytes, which can soon lead to clinical cardiac arrest.

Thus, heart rate and pulse waves are essentially systemic information processes, the analysis of which allows us to assess the functional state of processes at the microlevel of tissue functioning [54]. This became the scientific basis for the introduction of short heart rate variability recording analysis methods into diagnostics. Scientifically substantiated clinical interpretation methods enable objective assessment of stress and body fitness, and of the patient's functional health group and cardiovascular risk level [55-60]. Promising results are emerging from studies that, based on a combination of body bioimpedance analysis and short-form heart rate variability recordings, enable indirect assessment of cellular metabolic parameters [61], and so on. Thus, cardiography is moving from a method of visual analysis of heartbeat recordings to a diagnostic procedure in bioelectronic medicine/quantum medicine. In 2022, an official scientific guide to the use of short-form heart rate variability recording analysis in internal medicine was published [54] (Figure 6). The book describes an adapted, simplified clinical analysis method that is convenient for use in patient examinations by family physicians, internal medicine physicians, and other specialists.

The vegetative resonance testing method, or VEGATEST, is another classic example of *in vivo* measurement of electromagnetic processes in human cells. This method is closely related to the development of electroacupuncture and combines engineering discoveries with medical research in naturopathy, homeopathy, reflexology, and scholastic medicine [62]. The VEGATEST Method, or Vegetative Reflex Test (VRT), was developed in the early 1970s by the German physician Helmut Schimmel. This method is the result of more than thirty years of development and practical experience in the application of German electropuncture [62]. Schimmel improved the equipment for diagnostic dermatoelectropuncture and theoretically rethought the ideas of R. Voll's electropuncture diagnostics (Elektroakupunktur nach Voll, EAV) and W. Schmidt and H. Pflau's bioelectronic functional diagnostics [63]. Therefore, the VEGATEST Method uses electrical resistance readings at a single biologically active measurement point for diagnostics. This makes it possible to construct etiopathogenetic chains from frequency-wave complexes during dermatoelectropuncture. This is more convenient and more informative for the practical use of the dermatoelectropuncture technique by physicians [63]. For a long time, the method had limited use because the biophysical mechanisms underlying its validity were not understood. The Magneto electrochemical Theory of Metabolism and Life explained its position in terms of modern biophysical knowledge. Firstly, all atoms, molecules, and their complex combinations have specific electromagnetic parameters, with characteristic oscillation frequencies in Hertz, due to the constant, specific oscillation frequency/precession of nuclei in atoms. Therefore, the frequency parameters of chemical substances, tissues, and organ function-

ing processes in the human body, as well as those of most known microorganisms, have been scientifically established. [64] Secondly, existing theoretical concepts were supplemented by the Concept of Biophoton Signaling [65]. This concept offers a logical description of the origin and propagation of an electromagnetic information signal in the body. From the standpoint of modern biophysical

knowledge, this concept explains why the information signal of a test frequency-wave preparation, in the presence of the same frequency in the information quantum field of the human body, produces resonance [62]. The evolution and principle of the method are shown in Figure 8.



Figure 7. Title page of the textbook [54].

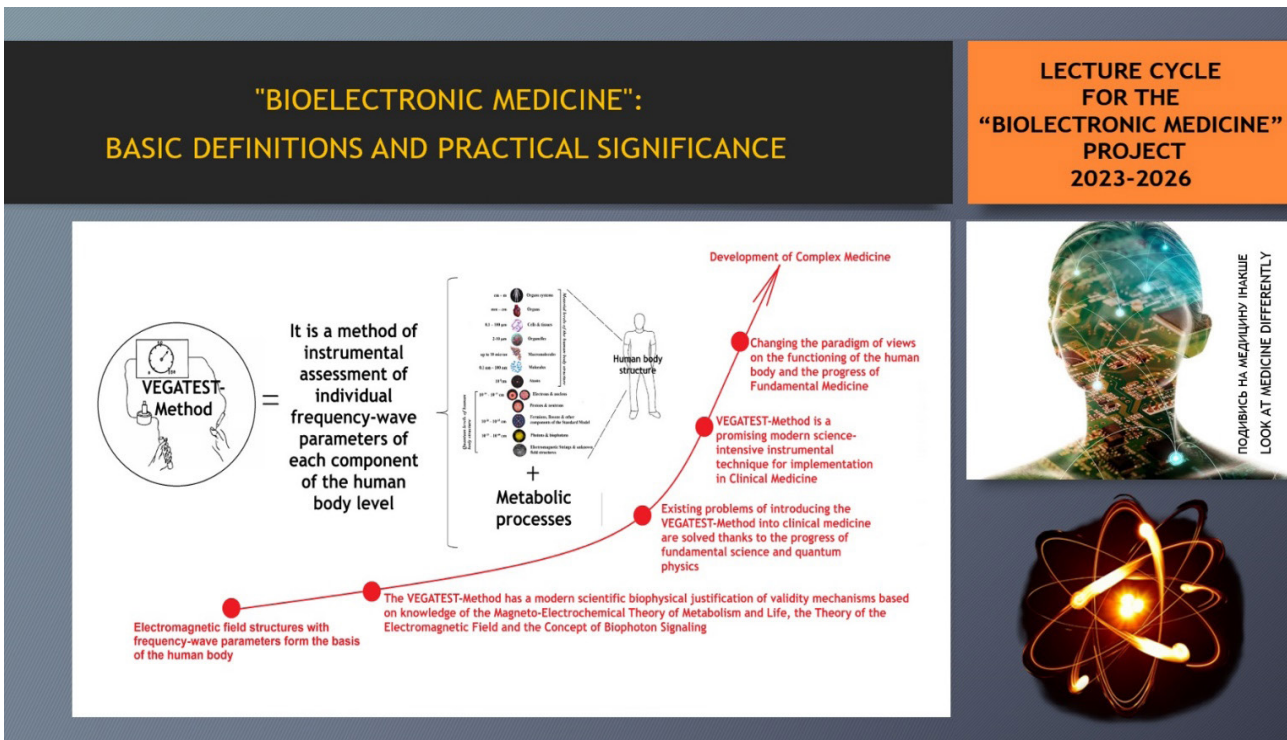


Figure 8. Evolution and principle of the Vega-test method. A fragment of the figure [62] is used.

Gas-discharge visualization/Electro-photonic emission analysis is another method of bioelectronic medicine. The technique was initially called bio electrography. Since the mid-20th century, the method has become known as Kirlianography [66]. In the second half of the 20th century, the physical principle underlying the appearance of luminescence in objects under short-term exposure to an electromagnetic field pulse was discovered. As a result, the method became known as gas-discharge visualization [66]. By the end of the 20th century, principles for the clinical analysis of luminescence from human fingers and toes were developed, and the relationship between their parameters and the functional state of the human body was proven [67, 68]. Scientific progress in the first quarter of the 21st century in understanding the role of biophotons in the human body as carriers of energy and information [69] enabled the biological basis for the validity of the gas-discharge visualization method to be explained. Therefore, alternative names for the technique have appeared in the scientific literature, such as “Electrophotonic Imaging” [70, 71] and “Electro-photonic emission analy-

sis” [72, 73]. The basic principle is as follows. Biophotons are carriers of energy and information in the human body, including through the Primo Vascular System (PVS) [74]. PVS is a scientifically proven morphological substrate of the channel-meridian system [75-79], whose topographic data are used by naturopathic doctors and reflexologists [80, 81]. According to concepts of Ancient Eastern Medicine and modern reflexology data, the fingertips are reflexogenic zones for the corresponding organs [82]. This explains why changes in luminescence parameters occur in the corresponding organ sectors on bio electrograms of human fingers [65, 67, 74]. Thus, the technique allows for an indirect assessment of the electromagnetic parameters of the functioning of zones and organs of the human body. Moreover, the use of modern computerized methods with the processing and analysis of digital images using neural networks makes it possible to obtain a large number of digital luminescence parameters and construct various visual models of the energetic functional state of the human body [73]. The evolution and principle of the method are shown in Figure 9.

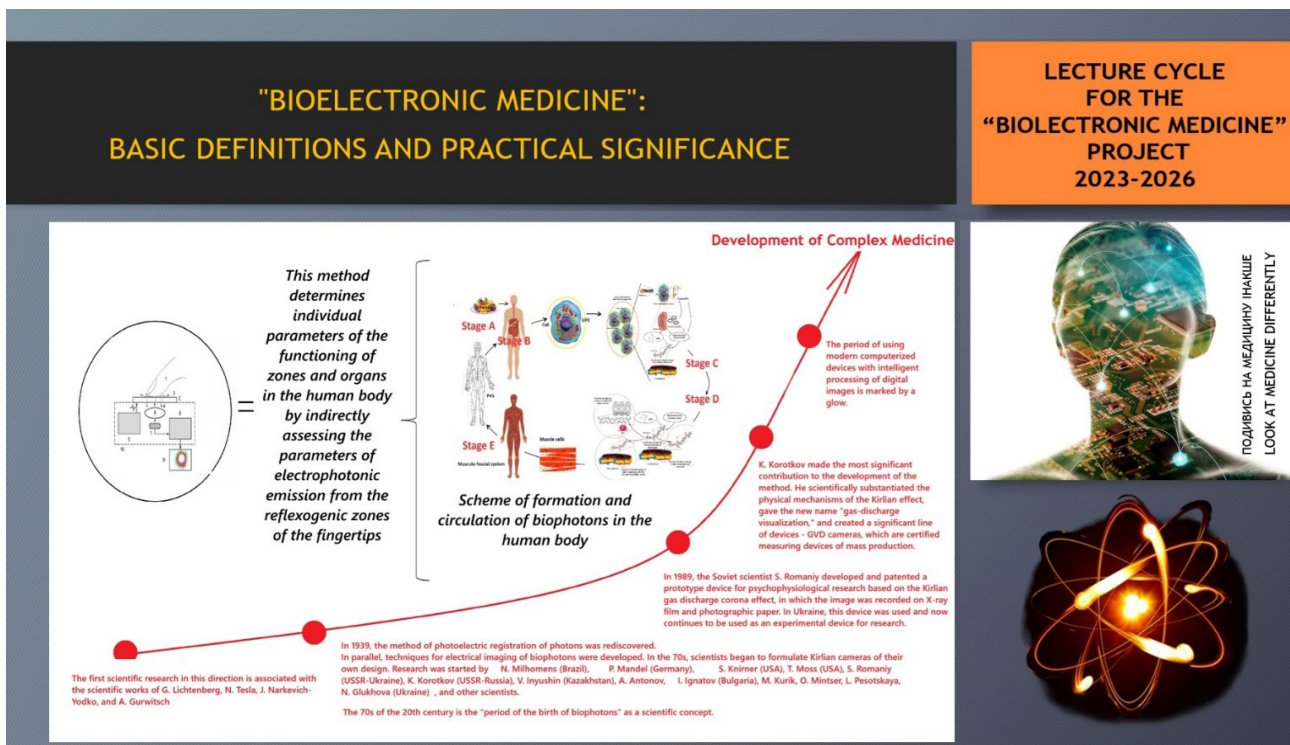


Figure 9. Evolution and principle of the gas-discharge visualization/Electro-photonic emission analysis method. A fragment of the figure [65] is used.

A fundamentally important aspect is that the methods described above have certified equipment at a relatively affordable cost and can be used in practical healthcare and preventive medicine. Magnetocardiography and magnetoencephalography can also be classified as diagnostic methods of Bioelectronic Medicine. These methods enable objective recording and evaluation of magnetic fields within the corresponding organ zones [83]. However, the equipment for these methods is costly and is available only at a few research institutions worldwide. This limits

their application. A similar situation is observed with other strategies for assessing biophoton emission from the human body in vivo [73].

Basic Concepts of Bioelectronic Medicine

The essence of Bioelectronic Medicine as a medical field is based on fundamental theoretical scientific knowledge that all molecules and atoms in the human body, at the subatomic levels of their structure, are formed by various types of energy, that all biochemical metabolic reactions occur due to the exchange of electromagnetic energy


between atoms, and that all atoms/molecules have specific frequency-wave characteristics of their electromagnetic state [17,33]. Therefore, if we extrapolate this knowledge to medicine, it follows that in a healthy body, all atoms and molecules have specific electromagnetic properties. These parameters determine the body's metabolic processes. If these parameters are within the norm, the person is healthy. In a healthy person, the exchange of electromagnetic energy between atoms ensures the normal, well-coordinated course of biochemical metabolic reactions in cells throughout the body. If the electromagnetic parameters of molecular atoms change for some reason, this leads to pathological deviations in their participation in biochemical metabolic reactions. Thus, disease arises, is associated with, and manifests itself through pathological changes in the electromagnetic parameters of molecular atoms. Long-term pathological deviations in the course of biochemical reactions are clinically manifested by deviations in laboratory parameters from the norm, and so on. This leads to a scientific understanding of the existence of a quantum level in the pathogenesis of internal organ diseases [17]. Further detailing and describing this level is a task for future research. Such developments are already underway. For example, issues of the pathogenesis of viral infections are being studied in this way [84], and so on.

Extrapolation of existing biophysical knowledge enabled the explanation and description of the electromagnetic foundations of biological life [69,85,86]. Thanks to this, it became clear that the phenomenon of biological life in a cell exists as long as the biopolymers of membrane structures are capable of generating and transporting electromagnetic coherent energy in the form of solitons [87-90]. Deoxyribonucleic acids (DNA) emit biophotons and create the information content of the coherent electromag-

netic energy of the cell [74]. The combined energies from DNA and electromagnetic fields at the cellular level form the cell's membrane potential, serve as an information carrier for all metabolic processes of the cell's life activity, and create the cell's electromagnetic field [74]. This electromagnetic coherent energy circulates within the cell, between cells in tissues and organs, creating electromagnetic currents. Thanks to this, all the molecules of all the cells of the body are united into a single functional whole, which is called a living organism [39-41]. The cessation of coherent electromagnetic energy generation by membrane biopolymers leads to the cessation of electromagnetic current flow and the disappearance of the action potential. This is cell death. When the information and energy components of the cellular electromagnetic field disappear, the chemical breakdown of molecules—the biological decomposition of body tissues—begins [17]. Thus, it is clear that the life of biological organisms is determined by and depends on electromagnetic processes at the microscopic level of their structure.

Bioelectronic Medicine is built on an understanding of the nature and role of electromagnetic processes in the life of body cells. All electromagnetic processes in cells have specific electromagnetic parameters [17, 33]. The total power of the cellular electromagnetic field and its frequency characteristics are key characteristics. These parameters can be objectively assessed and used as new promising methods. Deviations from the norm can be corrected by therapeutic electromagnetic stimulation of organ tissues using specialized physiotherapeutic devices. This is the basis for the principles of treatment in Bioelectronic Medicine. The key concepts of Bioelectronic Medicine are presented in Figure 10 [26].

**"BIOELECTRONIC MEDICINE":
BASIC DEFINITIONS AND PRACTICAL SIGNIFICANCE**



**LECTURE CYCLE
FOR THE
"BIOELECTRONIC MEDICINE"
PROJECT
2023-2026**

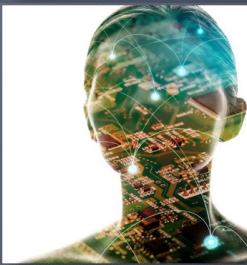
THESES OF BASIC CONCEPTS BM:

**QUANTUM LEVELS
BIOELECTRONIC MEDICINE (BM)**

1. The human body is formed by energy
2. Chemistry is a secondary phenomenon of electromagnetism
3. There is a corpuscle-wave model of the structure of the human body

THESES OF BASIC ASPECTS BM:

1. Quantum pathogenesis
2. Quantum pharmacology
3. Life is an electromagnetic process
4. Health is the normal course of electromagnetic metabolic processes, disease is their violation
5. Biological death is the cessation of electromagnetic metabolic processes
6. The frequency of functioning of a biological object is a diagnostic criterion
7. The frequency of functioning of a biological object is a therapeutic target



ПОДВИСЬ НА МЕДИЦИНУ ИНАКШЕ
LOOK AT MEDICINE DIFFERENTLY

Figure 10. Key concepts of Bioelectronic Medicine [26]

Practical Significance of Bioelectronic Medicine.

Bioelectronic Medicine is a promising medical field that logically complements and deepens knowledge in all areas of medicine. Therapeutic methods of Bioelectronic Medicine are a significant addition to the pharmacological treatment of internal organ diseases. Magnetic and electromagnetic fields exert biological effects on cells [90].

Comprehensive treatment of internal organ diseases using Bioelectronic Medicine techniques significantly increases treatment effectiveness. Therefore, research and development of such integrated approaches should be given greater importance in modern science. The practical significance of Bioelectronic Medicine is presented in Figure 11 and was detailed in the corresponding review [91].

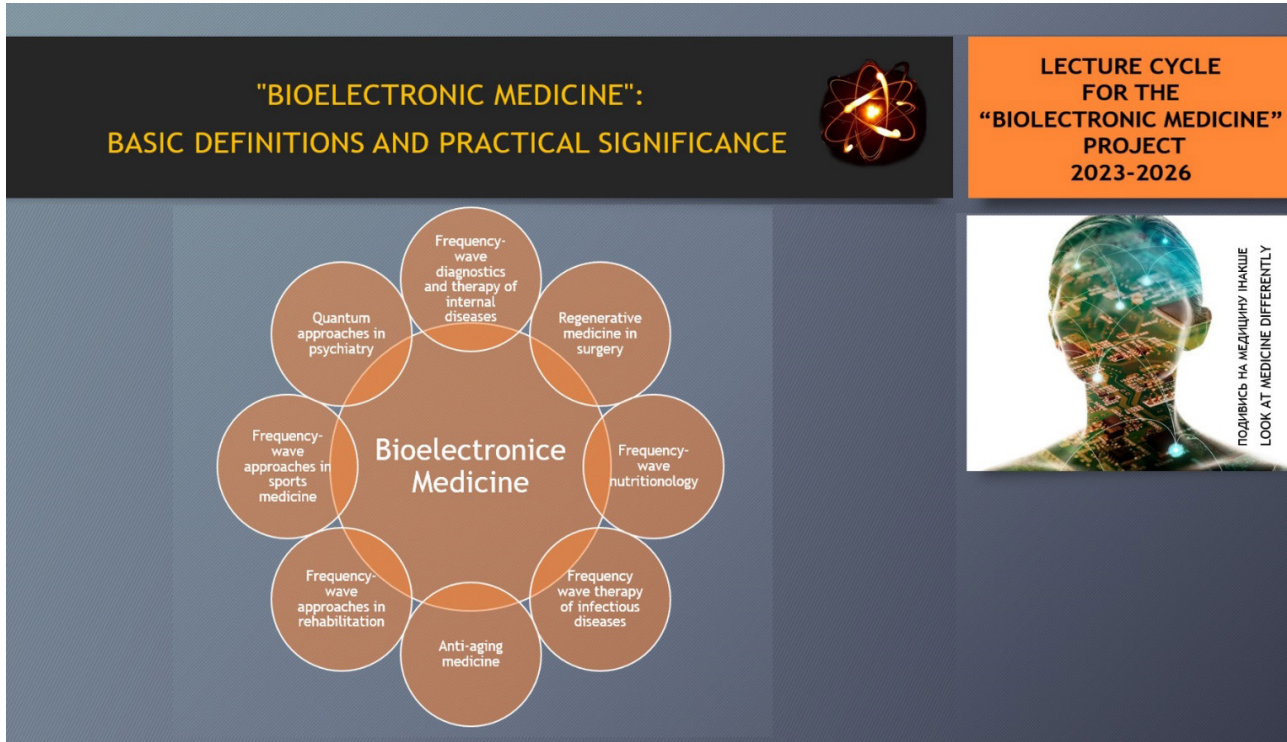


Figure 11. Key concepts of Bioelectronic Medicine [91]

Problems and Prospects.

The development of information and computer technologies is creating unprecedented conditions for the further development of Bioelectronic Medicine. On the one hand, understanding the role of electromagnetic processes in the human body opens new horizons for deepening fundamental medical knowledge and solving existing medical problems. On the other hand, technical capabilities for recording and analyzing an increasing number of electromagnetic parameters of the human body have emerged and continue to expand [92]. The ability to remotely process large arrays of digital data on the body's current electromagnetic parameters and their dynamics opens new possibilities for IT medicine. Bio waves in the human body are an objective source of important information about its functional state. The use of artificial intelligence and neural networks in processing their parameters is an important and promising direction for further progress in medicine. These issues are described in detail in the monograph [83] (Figure 12).

The challenges of developing Bioelectronic Medicine stem from the need to increase awareness among practicing physicians and medical scientists of its scientific basis. The interdisciplinary gap between existing biophysical knowledge and the existing medical paradigm must be

bridged.

Another critical challenge for the development of this field is the technical complexity and high cost of many methods related to recording and analyzing magnetic and frequency components of the human body. It is hoped that scientific and technological progress will resolve these technical issues in the future.

Conclusions.

1) A new layer of fundamental knowledge in quantum physics has formed a promising new transdisciplinary scientific field – “Bioelectronic Medicine.” This is the latest trend in the development of medical science and education that modern medical scientists must pursue. 2) The Magneto electrochemical Theory of Metabolism and Life is a biological theory that adapts knowledge of quantum physics to medical needs and serves as the theoretical basis for the further practical implementation of quantum medicine in educational and scientific medical fields. 3) The educational, scientific, and practical project “Bioelectronic Medicine” is a promising new “tool” for further developing the latest scientific medical perspective in medical students and doctors, as a guarantee of future progress in the medical field.

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Figure 12. Information about the new edition of “Advances in Bioelectromagnetism. Innovations and Applications in Healthcare” [83]

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«БІОЕЛЕКТРОННА МЕДИЦИНА»: ОСНОВНІ ДЕФІНІЦІЇ ТА ПРАКТИЧНЕ ЗНАЧЕННЯ

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Резюме. Це огляд першої лекції із серії «Біоелектронна медицина або подивитися на медицину по-іншому», в якій представлено та обґрунтовано її ключові поняття, значення та актуальність. Це освітній та науковий проєкт для подальшого розвитку медицини та її квантових галузей. Метою є наукова розробка та популяризація магнітоелектрохімічної теорії метаболізму та життя, яка об'єднує існуючі медичні знання із сучасним біофізичним розумінням організації та функціонування людського організму на нанорівні та глибше.

Медицина – це трансдисциплінарна галузь наукових знань, яка в сучасних умовах розвивається шляхом набуття фундаментальних знань з інших галузей. Важливо зазначити, що сьогодні, на початку 21 століття, склалися унікальні умови, які дозволяють сучасним вченим продовжувати здійснювати прориви в медицині. Це включає появу великої кількості принципово нових знань, отриманих завдяки дослідженням фізиків та біофізиків.

Ці знання продовжують інтегруватися в медицину, але повільно та складно. Для цього є кілька причин.

По-перше, сучасна наука продовжує переживати інформаційний бум: кількість наукових публікацій настільки величезна, що життя одного вченого не вистачить, щоб ознайомитися з ними.

По-друге, розвиток нових трансдисциплінарних знань значно ускладнюється через використання специфічної термінології, яку може бути важко зрозуміти вченим у біологічній та медичній галузях. Як наслідок, у науці виникають трансдисциплінарні розриви між галузями.

Прикладом цього є існуючий трансдисциплінарний науковий розрив між квантовою фізикою та медициною.

По-третє, для створення сучасної універсальної парадигми необхідна складна, тривала робота в системному аналізі та переосмисленні існуючих знань. Це вимагає наукових фахівців з відповідними професійними компетенціями у суміжних галузях. Необхідні також технічні умови для їхньої роботи та фінансування таких досліджень тощо.

Тому публікація «Подорож у тисячу миль починається з одного кроку» відкриває серію оглядів, присвячених розвитку системних медичних знань, та спрямованих на інтеграцію існуючих відкриттів у фізиці/біофізиці в медичну наукову парадигму.

Метою цього огляду є представлення наукової основи перспективного трансдисциплінарного наукового напрямку «Біоелектронна медицина».

Висновки: 1) Новий рівень фундаментальних знань у квантовій фізиці сформував перспективну нову трансдисциплінарну наукову галузь – «Біоелектронну медицину». Це новітня тенденція в розвитку медичної науки та освіти, якої повинні дотримуватися сучасні вчені-медики. 2) Магнітоелектрохімічна теорія метаболізму та життя – це біологічна теорія, яка адаптує знання квантової фізики до медичних потреб та слугує теоретичною основою для подальшого практичного впровадження квантової медицини в освітню та наукову медичні галузі. 3) Освітній, науково-практичний проєкт «Біоелектронна медицина» є перспективним новим «інструментом» для подальшого розвитку новітньої наукової медичної перспективи у студентів-медиків та лікарів як гарантія майбутнього прогресу в медичній галузі.

Ключові слова: медицина, біоелектронна медицина, квантова медицина, магнітоелектрохімічна теорія метаболізму та життя, нова парадигма, біофізика.

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