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Article

Bioecomedicine as a social determinant of the sustainable development of society

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Abstract: The aim of the research is to elucidate the features of the modern model of bioecomedicine and its components as a social determinant of sustainable societal development. The theoretical-methodological basis of the work was the complex use of scientific principles and a systematic approach, which determined the choice of research methods: general scientific and interdisciplinary. The concept generalized content is substantiated and the main lines of building the bioecomedicine model are characterized from the standpoint of information-structural modeling and sustainable development. Based on the structural-logical imperative, the object, subject, basic method and main concepts of this science sphere are characterized. The bioecomedicine principal idea as a social determinant of the sustainable development within a single information space is the unification of the knowledge information field of biology, ecology and medicine based on the use of the latest achievements in information technologies. It is proven that the algorithm for achieving the bioecomedicine global goal in the form of a set of principles reflects the essence of a systemic approach to solving the tasks of sustainable societal development by ensuring the system-environmental homeostasis of humans and the ecosystems that surround them.

Keywords: bioecomedicine; social determinant; informational and structural model; sustainable development; components of bioecomedicine

1. Introduction

In today's turbulent times, numerous trends in health and a healthy lifestyle are considered a social determinant of the sustainable development of modern society. The idea of a healthy person which is formed today is mainly connected with a harmonious, comprehensively developed personality. A healthy person in all respects can be called one who has the ability to react adequately and adapt to the conditions of ecological, biological and social environment, which is constantly changing, and a person who is able to improve morally, maintain high personal capacity (Znak et al., 2018).

At the contemporary stage of the research of this multifaceted problem, the idea

of health as an integrated system that is used to perform the basic function of human life and human life in society (Cramer, 2013). When it comes to the level of integral health its high degree should be characterized by the functional poise of the organism with the environment in the presence of a state of physical, mental and social comfort (Pyurko et al., 2022; Valles, 2018).

In modern conditions, the individual health of people is an indicator of their culture and, at the same time, the level of socio-economic development of each community, which is related to the way of life of citizens and their outlook on the health care system. It is not for nothing that human health is considered a social value, a constituent component of public wealth, and society itself determines the main vectors of use, protection and reproduction of health (Boychuk, 2017; Whyle and Olivier, 2021). Generalized analysis of the human health state is a necessary determinant and strategic reference point for the formation and development of human abilities and opportunities as a driving force and the highest goal of social progress.

The modern trend of health, as the highest value of a person and the basis of an active creative life, is considered one of the predictors of the sustainable development of society (Voronkova et al., 2023b). In turbulent times of social transformations, accelerated pace of life and other challenges, the importance of various aspects of health increases significantly, because only a person with the following qualities can be competitive: physical health, social adaptation, civic activity (Vysotska et al., 2018; Whyle and Olivier, 2021). In Ukrainian society, in conditions of socio-economic troubles, a difficult ecological situation, a low level of nutrition culture, medical and valeological knowledge, the practice of safe life activities and conflict-free behavior, hypodynamia and hypokinesia, an insufficient level of the culture of health preservation and health formation of the population is noted (Boychuk, 2017).

In the field of health, the goal of state policy is to ensure the maximum level of health of every citizen. However, it is a well-known fact that the modern medical field and the pharmaceutical industry provide the predominant development and advancement of the recent treatment technologies (Khristova, 2013; Khrystova, 2012a). However, the number of patients is not decreasing; on the contrary, an epidemic of chronic non-communicable diseases is spreading in the world, and among the population of the most active age (Jameson et al., 2020; Khrystova, 2012b). Modern patterns of European integration require every person to exert maximum creative effort, activate physical and intellectual discourse, which is possible only in the presence of good health (Gomez-Pinilla, 2008). Healthy members of society form the nation’s wealth and determine the personal and social success of the community in various spheres of activity.

The transversal integrity of individual health is determined by integral systems that determine the formation and maintenance of a specific state, a certain level of health (Olsen and Dahl, 2007; Pengpid and Peltzer, 2019). Such complexes systematically characterize any manifestation of health, are mutually coordinated and interconnected, characterized by quantitative and qualitative features: general physical development and the state of its individual components; reserve capabilities

of basic vital systems; functional level of the immune system and non-specific resistance of the body; the presence or absence of chronic pathologies, developmental defects; the ability to eliminate metabolic products and endotoxins; the level of moral and volitional and value-motivational instructions (Traina et al., 2019).

Based on the knowledge conversion of modern science, it can be stated that for the further global disclosure of the phenomenon of health, not only the universalization of the very definition of "health" is needed, but also the application of new creative approaches and principles to its research, where the dominant place is occupied by the algorithms of bioecomedicine and information vectors (Khrystova and Kovalchuk, 2021; Nanotechnology, 2019; Nikitenko et al., 2023). Thus, the approach to studying health in the informational context was clearly distinguished (Iranbakhsh and Seyyedrezaei, 2011; Voronkova et al., 2023a).

Global pollution of the environment, as well as "clogging" of a person's internal information field with a wide variety of information, the discomfort of a person's habitat lead to negative changes in the body. The need for generalization and systematization of modern ideas about human health led to the formation of a new synergistic scientific direction—bioecomedicine. This is not an accidental combination of biology, ecology and medicine, but a new interdisciplinary direction that covers informative knowledge of biology, ecology and medicine, aimed at achieving the global goal of preserving human health (physical, mental and social status) and forming a harmonious developed personality in the system-environmental information space. To date, the processes, methods and techniques of forming a harmonious personality in various eco-environments, as well as methods and techniques of forming eco-environments comfortable for humans, including artificially created ones, have been determined. The effective solution of complex and multifaceted tasks of bioecomedicine is possible owing to the rapid development of information technologies, especially various software and technical tools, methods, models and algorithms. Therefore, bioecomedicine summarizes the knowledge of the subject fields of biology, ecology and medicine and transforms them into a certain system of knowledge aimed at solving the most relevant problems from the point of view of an active and fulfilling human life.

It is possible to form a harmonious personality only by maximally developing its potential vital forces. And for this, it is necessary to take into account the ecology of not only the natural environment, but also the information environment, which is gaining more and more importance in connection with the entry of humanity into the era of information civilization. However, to date, questions regarding the object, subject, basic method and basic concepts of this field of science as a social determinant of sustainable development of society, which determines the relevance of the work, remain insufficiently resolved.

2. Materials and methods

The theoretical-empirical and methodological basis of the research was a transversal combination of the principles of scientific and systemic approaches, which led to the coordinated use of the following research methods: general

scientific (analysis, synthesis, systematization, summarization of literary sources); interdisciplinary (structural and systemic approach of problem consideration, axiological method), which made it possible to analyze the peculiarities of the phenomenon of bioecomedicine, became the basis for a detailed study of this phenomenon under the conditions of transformation of modern society. The empirical basis is the factual material of scientific articles published in scientific journals and collections of articles, as well as reports and abstracts of reports at scientific conferences.

The analysis of literary sources involved the content study of documents and logical procedures for the selection and dissection of complete scientific works into certain components, elements that were considered through the bioecomedicine focus. Analysis of factual material is a mental operation (action) that allowed, in the movement process from complex to simple, from accidental to necessary, from diversity to identity and unity, to identify the bioecomedicine components, to clarify the relationships between them, to determine the bioecomedicine principles.

The literature data synthesis included the process of combining previously separate concepts into a single whole in the aspect of bioecomedicine, establishing connections between numerous source materials; it is not a simple summation of information, but a meaningful combination of individual parts or sides of the object within the defined research problem. The use of synthesis allowed combining individual components of bioecomedicine in a certain way, to establish essential connections between them and environmental conditions (social and ecological).

During the systematization of primary sources, was organized and the collected and processed (analyzed) data was brought into a consistent, scientifically reasoned presentation. This approach led to the creation of an indicative informational and structural model of bioecomedicine and the disclosure of the principles of this field of knowledge.

Generalization of information from literary sources involved a logical process of transition from individual to general, selection of the most essential and general features of bioecomedicine (concept, object, subject, methods, principles, leading ideas).

The structural and systemic approach was aimed at clarifying the real difficulties that arose in the process of researching the bioecomedicine phenomenon and at developing options for their elimination; included consideration of the object as a whole set of structural elements and a set of connections between them. The systemic approach made it possible to consider the modern model of bioecomedicine as a social determinant of the sustainable development of society, its components, in inseparable unity with social and environmental changes.

The axiological method was used to study the achievements of the scientific community in the field of the information concept of bioecomedicine; was based on the philosophical teaching about ethical, moral and cultural values as the meaning-forming foundations of human existence.

The combination of the chosen research methods is justified by the complexity and ambiguity of the bioecomedicine phenomenon and the need for in-depth knowledge of this phenomenon, which is not limited to the analysis and

systematization of a wide range of scientific and popular scientific literature, but reaches the level of worldview generalizations and requires the complex application of structural-systemic and axiological approaches.

The research aim is to reveal the features of the modern model of bioecomedicine and its components as a social determinant of the sustainable development of society.

3. Results and discussion

According to the modern ideas and the definition of information-structural model, the latter requires a verbal description of individual structural blocks of bioecomedicine as a problem. Bioecomedicine is a synergistic field of science and practical activity, which is characterized by a purposeful synthesis of informational knowledge of biology, ecology and medicine; generates new technological solutions aimed at achieving and expanding the health zone, as well as at the formation of a harmoniously developed personality. The informational and structural perspective of the specified field of science as a systemic problem includes the following interrelated partners: informational and scientific content of subject sphere; informational-technological support of scientific research (**Figure 1**).

The first component contains three interdependent subject-scientific fields that combine the necessary volume of factual knowledge of the transversal focus of bioecomedicine: human biology, ecology and medicine. The main definition for the selection and systematization of specific information in these subject-scientific fields is the correspondence of knowledge to the global imperative of bioecomedicine research, namely: the generalization of knowledge about the physical, mental and social status of human health in the changing conditions of various ecological environments; research on the dependence of health, as a systemic entity, on the mutually coordinated influence of the most important factors: genetic, environmental, and lifestyle; formation, expansion and deepening of the theoretical content of human health in a single information space, which includes intra-systemic (human) and systemic-environmental (human + environment) links.

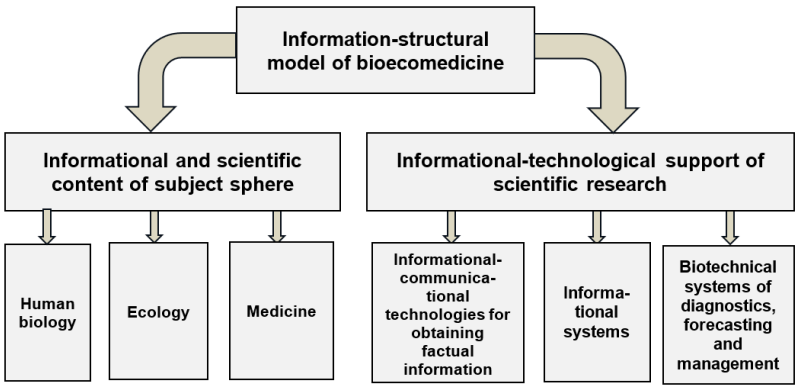

Figure 1. Informational and structural model of bioecomedicine.

According to this criterion in the subject area of human biology it is necessary to know about the physiological specificity of individual organs and life support systems of the human body, the principal laws and generalized mechanisms of

normal coexistence and functional activity of these organs and systems. In the field of biological science, theoretical and empirical data in the aspect of intrasystem dynamics of the structural and functional organization of brain structures are also very important. The brain is considered not only as the controlling organ of the functional state of the human organism, but also as an object of knowledge of complex thinking processes.

Ecological science is dedicated to the study of structural features and regularities of the functioning of biological systems in interaction with each other and with the surrounding environment, the effect of civilizational processes on the environment in order to prevent the negative consequences of man-made activities. Among a large number of ecological problems, the state of human health is the central system-forming reference point that unites research on the complex analysis of the specifics of the action of various external agents on the human body. In the modern period, a significant question arises regarding the influence of environmental factors on the health of the population. To solve this issue, it is necessary to learn to objectively evaluate both the state of people health and the state of the surrounding environment. It should be noted that the environment is diverse, unstable and multifactorial.

Knowledge of the econorm as a system-environmental homeostasis of human interaction with various environments—natural (environment), social, informational and spiritual is mandatory for bioecomedicine as a problem of this subject sphere. Equally important are the knowledge of methods and techniques for diagnosing the functional state of a person in conditions of extreme environments, his ultimate adaptability to them, as well as knowledge of methods and means of maintaining systemic-environmental homeostasis in various extreme eco-environments. The latter is logically connected with knowledge about methods of “treating diseases” of various ecological environments surrounding a person. The term “treatment of diseases” means the creation, if it is possible, of such an ecological environment (natural, social, informational, spiritual) that would not harm a person’s health and contribute to the disclosure of all his potential: physical, spiritual, intellectual.

In the subject field of medical knowledge, it is advisable to implement traditional content about the functioning of organs and systems of the body in conditions of various pathological conditions. It is also necessary to investigate deviations in the structural and functional organization of the nervous system, in particular the brain, and identify the prevailing vectors of these changes. Recently, the coordinated possibility of using knowledge about methods, techniques and criteria for monitoring the structural state of organs and physiological processes in body systems at all levels of the organization, as well as about algorithms for choosing preventive, medical treatment and rehabilitation measures. All medical knowledge concerns the return of pathologically altered functions to normal functioning. Along with the task of returning to health, the task of forming, maintaining and expanding the health zone of a practically healthy person is becoming increasingly important. Therefore, it is logical to single out a block of knowledge about algorithms for choosing evolutionarily adequate management actions for the purpose of forming, maintaining and expanding the health zone.

Therefore, human health in the modern sense is the normal functioning of all its statuses as a potential basis of the individual and an adequate systemic and environmental manifestation of the individual. Therefore, in our time, the fact that the formation, maintenance and strengthening of human health depends on a single field of knowledge of various subject areas is becoming more and more obvious. Combining the knowledge of the subject fields of biology, ecology and medicine as the most important for human health is the first contribution to the formation of a healthy society of the future.

The second link is informational-technological support of scientific research is divided into the following components: information and communication technologies for obtaining factual information (includes methods and technologies using which new knowledge is obtained); information systems (complexes of software and hardware that provide collection, storage, processing and transmission of information); biotechnical systems of diagnosis, forecasting and management (based on the use of biological and technical methods for monitoring the functional state of the organism).

The first component is divided into: data awareness technology—obtaining information; technology of information awareness—acquiring of knowledge. It should be noted that this division of the first component corresponds to the main idea of information technologies, namely the awareness of the triad "data-information-knowledge".

The "Information Systems" component in its network is divided into: reference and information systems; information and analytical complexes (diagnostic, predictive, control and follow-up, which are programmed to function in different time limits: constant monitoring of the state of research objects in real time or discrete-continuous monitoring); information and consulting tools (knowledge bases, expert systems, interactive interfaces); expert and polyalgorithmic expert monitoring and management systems (based on expert knowledge and algorithms).

The isolation of biotechnical systems of diagnostics, forecasting and management as a separate link in information systems (since sometimes a biotechnical system can be considered as a kind of information system) is justified by their direct connection with the patient (regardless of their state of health), in comparison with information systems that may have a direct or indirect connection with the patient. Information systems also interact with the information field of knowledge about the surrounding ecological environment in which a person is.

The component selection of the research information and technology base together with its components is aimed at simplifying and systematizing the processing of large volumes of information in the multifaceted field of bioecomedicine knowledge. The main goal of this link is to collect, store and analyze the information field of knowledge related to human biology, ecology and medicine, as well as to transform this knowledge to solve the bioecomedicine problems.

Therefore, the information and technological support of scientific research allows to extract reliable and significant information from a huge amount of experimental data and present it using language or images (sound, visual, symbolic), convenient for the user, which makes it possible to consciously move towards

solving the bioecomedicine problems, increasing the level of generalization and systematic research. This link should facilitate and streamline work with large flows of information in such a multifaceted field of knowledge as bioecomedicine.

Let us consider several definitions that encapsulate the essence of bioecomedicine from the viewpoint of the object, subject and research tasks. It is necessary: to present bioecomedicine as a regulated system of knowledge; to form generalizations that allow to find a connection between the information fields of subject knowledge of biology, ecology and medicine; to help transform knowledge from these subject spheres into a new defined knowledge system of interdisciplinary research in bioecomedicine.

First of all, it is necessary to define the object, subject and basic method of bioecomedicine.

The bioecomedicine object is a complex system: a person + a surrounding eco-environment—natural (environment), social, intellectual, spiritual.

The subject of bioecomedicine processes, methods and ways of forming a harmoniously developed personality in different eco-environments, as well as methods and ways of forming comfortable for human eco-environments.

The main method of bioecomedicine is information technology—a variety of software and hardware tools, methods, models and algorithms, that is, an information product that allows solving various scientific and technical problems.

The goals of bioecomedicine are: diagnosis of the state of the object of bioecomedicine—the selection of informative (essential) knowledge obtained in the subject sphere of human biology, human ecology and medicine, necessary for a sufficiently complete study of a specific object of bioecomedicine depending on its properties, characteristics and interaction of components about of the object (person + environment) among themselves; forecasting the state of the object of bioecomedicine in different conditions of the interaction of its components. Under different conditions of interaction, we understand a simultaneous change in the state of a person and the environment or a change in the state of a person in relation to an unchanged environment; definition of the econorm of human health as a mutually coordinated system of physical, mental and social status in the conditions of a changing eco-environment; development (synthesis) of management actions aimed at preserving the health of the bioecomedicine object and affecting human health directly and indirectly through «environmental health»; development of methods and techniques of information technologies that transform the field of subject knowledge of biology, ecology, medicine into the knowledge field of bioecomedicine.

It should be noted that the list of goals is open, and each of them, in turn, is divided into a number of subtasks in accordance with the multifaceted nature of the problem of bioecomedicine.

The doctrine of sustainable development is a systemic social and public doctrine that aims to change the relationship between a human and nature in order to expand the opportunities for economic growth and to create a coordinated global strategy for the survival of humanity, focused on the preservation and restoration of natural communities on the scale necessary to return to the limits of economic capacity of the biosphere. The main idea of bioecomedicine as the social

determinants of sustainable development of society within a single information space, as a single information space consists in unifying the information field of subject knowledge of biology, ecology and medicine based on the use of the latest advances in information technologies, which in turn are based on the advances in cybernetics, computer science and telecommunications. It will describe the principles of the unity of the information space of bioecomedicine.

The principle of generalization of the knowledge's information field. The general picture of the information field of interrelated flows of knowledge in the subject sphere of biology, ecology and medicine, which are dynamically changing, is presented as a function of the specific task of the interdisciplinary study of bioecomedicine that is being solved.

The principle of systematic research. In order to optimize the solution of the tasks of bioecomedicine, it is necessary to consider the object as a whole system, revealing in it a variety of types of connections and reducing them to a single theoretical picture. It should be noted the relationship between the principle of systematic research and the principle of generalization of the information field of knowledge.

Systematic aims the researcher at a complex intra-systemic study of the interconnected functioning of the physiological systems of the body, on the one hand, and the system-environmental interaction of a human with the environment—on the other, which allows to identify in these interactions the general and specific patterns of the influence of the environment on human health as unity of physical, mental and social statuses. The system approach tells the researcher, who is solving a specific problem, what should be included in the general picture of the information field of knowledge in the subject sphere of biology, ecology and medicine.

The principle of homeostasis at different levels of biosystem organization. For the harmonious and evolutionarily adequate functioning of the complex object of bioecomedicine "human + eco-environment", it is necessary to maintain a dynamic balance of system-environment interaction in the conditions of changing eco-environment, onto- and phylogeny. Thus, the observance of this principle as an attribute of systemic is aimed at the formation of the harmony of the bio-eco-object.

The principle of interaction adequacy between the system and the environment. To ensure the adequate functioning of the object of bioecomedicine in all the diversity of its conditions in relation to human health—its physical, mental and social state, as well as the state of the eco-environment, including the extreme one with which a person interacts, it is necessary: individually objective adaptation is necessary system-environment interaction, i.e., intra-system adaptation of a specific complex object of functioning "human + eco-environment".

The intra-systemic adaptation of such a complex object should be understood not only as mutual adaptation of human-ecosystem, but also as adaptation of only human to ecosystems or only ecosystems to human. At the same time, individual-object adaptation can be carried out both at the expense of evolutionary adaptation mechanisms and at the expense of external control actions.

The principle of system-environment interaction adequacy makes it possible to understand that the process of formation, preservation and development of human

health should be based not only on its ability to adapt to environmental conditions, but also on the transformation of the environment in the interests of human health, its physical, spiritual, intellectual and social needs. Thus, compliance with the principle of interaction adequacy between the system and the environment is a necessary condition for the implementation of the principle of homeostasis at various levels of the organization of bioecosystems.

The principle of evolutionary compensation. Evolutionarily adequate management actions are a priority to ensure individual-object adaptation. In this case, evolutionary conformity is determined by the specific object of bioecomedicine.

The principle of humanization. To ensure the comfortable life of a person in the surrounding eco-environment, regardless of his physical, mental and social status, it is necessary to form such eco-environments that are adequate for the individual, meet his physical, spiritual, intellectual and social needs and contribute to the development of their potential abilities.

The principle of ethics and aesthetics of human interaction with environments. For the formation, preservation and development of health as an alternative to the endless treatment of human and environmental diseases, it is necessary to cultivate a conscious caring attitude towards the environment and a conscious caring attitude towards the environment, remembering that the main commandment of medicine is "Do no harm", which applies to humans both directly and indirectly, through the eco-environment that surrounds it.

The principle of intellectualization of the information space of bioecomedicine. In order to optimize the process of solving the tasks of bioecomedicine in the unified information field of knowledge of the subject fields of biology, ecology and medicine, it is necessary to use the latest information technologies, in particular methods, algorithms, mathematical, information and verbal models, hardware and software, as a result of which an information product is created, the power of intellectualization of which information is determined by the researcher's ability to form it and obtain new knowledge, including those that go beyond the scope of the task.

Therefore, the bioecomedicine development is due to the need to help people optimize their existence in a diverse environment. After all, at the center of the development of civilization is a person who lives in harmony with himself and the environment. Ensuring this harmony requires a change in the stereotype of values, humanization of society, integration of the information resource accumulated by the individual and society. The bioecomedicine tasks are consistent with certain provisions of the concept of sustainable development of society and include:

- harmonization of the coexistence of man and nature;
- environmental protection in the process of social development;
- assessment of the environmental consequences of all types of human activity, which can negatively affect both the "health" of the environment and human health;
- reducing the risk of human illness;
- providing access to the information field of bioecomedicine knowledge, including environmental information about hazardous materials and types of

human activity.

Sustainable (constant) development expresses a fairly simple idea: achieving harmony between people, between societies and nature, resolving contradictions that exist in our time (contradictions between nature and society, between ecology and economy, between developed countries and those that are developing, between rich and poor, between already formed needs of people and reasonable needs, between present and future generations, etc.). Bioecomedicine as a field of practical activity will make it possible to form a new, different from a purely medical, idea of health, the causes of pathology and create optimal technologies aimed at maintaining and expanding the "health zone" of a person, in particular—through the improvement of all types of the environment.

4. Conclusions

Therefore, bioecomedicine is a modern and priority direction of human biology, ecology and medicine against the background of sustainable development of society. The conceptual foundations of this branch of science include the modern definition of this concept and the bioecomedicine interpretation as an interdisciplinary division of science and practice in conditions of harmony between people, between societies and nature. The principles of health promotion are an alternative to the treatment of diseases. The task of bioecomedicine is to learn to assess the limits of harmonious human interaction with the environment and to learn the mechanisms that ensure this harmony. Solving this task requires informational integration and transformation of knowledge accumulated in the subject areas of human biology, ecology and medicine, building an information space of bioecomedicine using the latest information technologies for the development of adequate and optimal measures, including diagnostic, therapeutic, rehabilitation, and preventive measures. This space is a unified system of knowledge of these subject areas, which are focused on the formation, preservation, development and restoration of human health, which functions in various environments. The algorithm for achieving the global goal of bioecomedicine in the form of a set of principles reflects the essence of a systemic approach when solving specific problems.

Based on the structural-systemic approach, it was determined that the informational-structural aspect of bioecomedicine as a systemic problem has a certain structure (the informational-structural model of bioecomedicine) and is formed from the following interdependent components: informational-scientific content of subject areas; information technology support of scientific research. The first link includes three interdependent subject-scientific fields that combine human biology, ecology and medicine. The second component unites the following patterns: information and communication technologies for obtaining factual information, information systems, biotechnical systems of diagnostics, forecasting and management.

It was determined that the bioecomedicine object is a complex system: a person + the surrounding eco-environment—natural (environment), social, intellectual, spiritual; the main method of this branch of science is information technology. It is characterized the main principles of the unity of the information space of

bioecomedicine: the principle of generalization of the information field of knowledge, the principle of systematic research, the principle of homeostasis at different levels of biosystem organization, the principle of adequacy of interaction between the system and the environment, the principle of evolutionary compensation, the principle of humanization, the principles of ethics and aesthetics of human interaction with the environment, the principle intellectualization of the information space of bioecomedicine.

Today, people increasingly realize that the formation, preservation and development of their health depend more than ever on a single field of knowledge of various subject spheres. The combination of knowledge from the subject areas of biology, ecology and medicine as the most important for human health is the first contribution to the formation of a healthy future society. The algorithm for achieving the global goal of bioecomedicine in the form of a set of principles reflects the essence of a systemic approach to solving specific tasks of sustainable development of society thanks to ensuring the system-environmental homeostasis of body and the ecosystems that surround it.

Prospects for further research in this direction are work on the components' specification of the bioecomedicine information space, the architecture development of the information space of this knowledge field and the computer-information space of bioecomedicine.

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