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SOME ISSUES OF THE FORMATION OF THE SUBJECT AREA OF BIOPHYSICS

Abstract: This article analyzes the important issues of the formation of the subject area of biophysics.

Key words: science, scientific knowledge, biophysics, biophysical problems, entropy

Biophysics applies physical and mathematical research methods, concepts of physical chemistry and classical physical laws of the surrounding world to the study of living biological systems at different levels of their organization - molecular, membrane, cellular, population. Despite its "double" name, biophysics as an interdisciplinary science uses knowledge from many areas: physics, biology, mathematics, chemistry, ecology and medicine

Any picture of the world as its integral part requires the inclusion of some idea of life. In accordance with the natural attitude, the living is usually understood as different from the inanimate. Many questions arise here, and one of them is whether a living thing possesses some specific form of integrity or, on the contrary, is reduced to a simple combination of lower forms of organization. A significant part of natural philosophical ideas was focused on identifying specific characteristics that distinguish living things as a special region of existence from other regions of the cosmos. The establishment of these characteristics, which would demarcate between living and inanimate objects, has been engaged since Antiquity. Attempts were constantly made to determine the relationship between the regions of the living and the inanimate in the world, to create a picture of the world where the living is specially highlighted, as well as attempts to determine the living place among other phenomena. Historical

outline of the problem. Aristotle includes biological problems in the subject area of physics and history. At the same time, physics was a general science of nature as a field of natural movements. The story was a story about the morphology of animals. The specificity of life is based on the presence of the soul as the entelechy of the living, that is, as the cause of a special type of movement characteristic of living organisms. Aristotle's tools and approach turn out to be a working tool with sufficient heuristic potential and have been used by biologists, physiologists and doctors for many centuries, and the principle of entelechy becomes the basis for such a movement as vitalism. The Stoics reduce the principle of organizing a single being to the interaction of active and passive elements, which endows the entire cosmic organism with pneuma or soul. Within the framework of the Stoic concept, the living turns out to be a certain level of organization of bodily structures. But this approach, which endows the whole cosmos with the soul and does not draw a clear line of demarcation between the living and the inanimate, turns out to be too general, natural-philosophical, to have a noticeable heuristic potential in the framework of real scientific research. The atomic concept of epicureism also considered the living and inanimate as components of a single world, organized on a single basis, and also turns out to be more of a natural philosophical doctrine. Physicians empiricists have developed experimental morphology and anatomy, thereby gaining empirical material, but the level of their generalization is insufficient to build a theory.

The Middle Ages immersed the problem of the living in the relationship “Man - God – World”, the living is included in the religious picture of the world as the creation of God, and is practically not considered within the framework of science. New interest in the problem of the inclusion of living things in the structure of the cosmos appears in the New Time. The secularization of scientific knowledge leads to attempts to consider the living by analogy with the consideration of the inanimate world by means of new mechanics. R. Descartes

builds a picture of the world as based on uniform mechanical principles of movement, and living things are included in the world by analogy with an automaton. J. La Mettrie develops the idea of a single mechanistic view, understanding mechanics more broadly, as a field of modern physics. The works of these authors, breaking with the religious picture of the world, determine the program of the natural-scientific description and explanation of the living. In the atomism of P. Gassendi, the soul is the most delicate body, like everything in the world consisting of atoms, animate and living is included in the world on a common basis. In parallel with attempts to theoretically comprehend the ratio of living and nonliving, there are attempts to experimentally study the influence of physical phenomena on biological objects. The experiments of L. Galvani and A. Volta on "animal electricity" turn out to be key here. I. Goethe created a comparative morphology (and introduced this term) of plants and animals, and theoretically disputes the understanding of living things and nature as a whole as a mechanism, assuming the presence of an animated unity of nature, but this generalization of it is rather poetic and metaphorical. The development in the 19th century of physics and biology as independent sciences with diverse branches of their own led to the fact that an interdisciplinary field of research began to form at their intersection. On the other hand, in the XX century. theorization, mathematization and physicalization of sciences in general, but primarily of natural sciences, are undergoing great development, which contributes to the synthesis of physics and biology, which is necessary for the disciplinary separation of biophysics as a branch of science by the middle of the 20th century.

Thus, despite the long and rich history of the relationship between the physical and biological, biophysics as a discipline turns out to be quite young. Nevertheless, biophysics is an example of a non-classical natural science that has taken an important place in the structure of modern natural science. The number of teams doing work on biophysical problems is constantly increasing.

By now, biophysical research is becoming more widespread and an ever wider field of application. Such a rapidly developing applied discipline as medical physics is directly based on biophysics. 5 The disciplinary separation of bioinformatics also testifies to the fruitfulness of interdisciplinary interaction between biology and physics, since bioinformatics proceeds from a basic understanding of the molecular structure of a gene and the possibility of physicochemical changes in the genome. However, such a field of knowledge as biophysics, with all its rapid development, is still underdeveloped. In the works of scientists engaged in biophysical research, there is a noticeable desire to determine the specifics of this subject area, and it is presented either as a section of physics, then as a section of biology, or as an independent interdisciplinary field of science. From the point of view of philosophy and methodology of science, various strategies for the definition and development of biophysics can also be distinguished. This can be a strategy of reductionism, when physics is considered as the foundation for any other natural science developments, as a theoretical basis and as a methodological model. Another strategy is focused on the independence of biological and then biophysical research and even on the relative isolation of this subject area from the area of pure physics. It is expressed in the problematization and concrete scientific development of both the ratio of the own conceptual structures of physics and biology, and their interdisciplinary synthesis. At the same time, the philosophical and methodological understanding of the processes of development of biophysics is clearly insufficiently developed. Within the framework of the philosophy of biology, the questions of the physicalization of biology and physical reductionism are raised, which only indirectly relates to the problems of the formation of biophysics as an independent discipline. The main works related to the introduction of the conceptual framework of biophysics are also insufficiently studied from a philosophical and methodological point of view. The prerequisites for the design of the subject area of biophysics as an

independent field of research, the processes of the formation and development of biophysics as a branch of science, the formation of its own conceptual basis remain insufficiently clarified.

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