Bioplasma and Physical Plasma in Living Systems. A Study in Science and Philosophy

Summary

Modern biology and natural science face a challenge of explaining a possible connection between the fourth state of matter, the physical plasma, and life itself. One of the basic two possible assumptions is that plasma may occur in organisms, yet plays no essential role in them. The other may be realized in three ways: (1) plasma is playing an essential intra-organismal role, (2) it participates in the origination of life and in inter-generational transmission of life, and, finally, (3) plasma functions as a receptor-like medium interacting with environmental agents.

The first suggestions that the plasma state may occur in biosystems were made in the 1960's. Herbert Frőhlich mentioned marginally possibility of plasma oscillations in biosystems in his discussion of possible Bose-Einstein condensations in biostructures. Stefan Manczarski pointed out to mitochondria as a place where electronic plasma plays the role of the receptive medium to the external radio waves. At the same time, Włodzimierz Sedlak (1967) and Victor M. Inyushin (at al.) started a long series of publications initially devoted to the possible occurrence of the physical plasma in biosystems, and, later, to the plasma that is specific to biosystems but having only some properties common with or analogous to it. Sedlak put forth a lot of effort to formulate a comprehensive description of the properties and roles of bioplasma while Inyushin paid more attention to practical applications of the hypothesis that bioplasma may be a component of biostructures (medicine and agriculture).

Both approaches were met with considerable interest and, what is natural in such cases, the discussion on the concepts begun. The interesting thing in those discussions, however, was that the scientists charged both authors of making significant factual as well as methodological errors. At the same time, they did not undertake any investigation of the hypothesis on their own. On the other hand, scholars from within the humanities community (including philosophy), as well as some columnists took side, to a certain degree, with both Sedlak and Inyushin. They shared the view of these authors that putting forward the concept of bioplasma marks a substantial progress in science and it brings about new issues in the philosophy of nature, the man including. This brought a sharp

controversy between extremely skeptical, and the positive assessments of these concepts.

In the background of these controversies a research was made (Marian Wnuk, the author, and others) focused on the question of the possible existence of physical plasma in biosystems. This avenue of investigation was also greeted with skepticism (Quickenden &Tilbury 1987), although the method of investigation into this question was positively assessed. Now, after more than two decades since the development of these concepts, and after the discussion about their contents, it seems that the controversy died down. The easiest way of explaining this fact would be that the hypothesis on the existence of physical plasma in biostructures, as well as the concept of bioplasma based on it, has been proven to be false and/or infertile in science. It is, however, not so.

The question about the possibility of the existence of plasma in biostructures continues to be open. As a consequence of this, many other questions remain to be open. They relate to the plasma's (or bioplasma's) possible role in biosystems as well as the philosophical plane on which the concept of plasma in organisms emerged and in what philosophical contexts the issues can still be discussed.

In this study, the numerous and heterogeneous sets of information presented by the mentioned authors were ordered, to make possible a broader look at the present status of these concepts and to show the above mentioned philosophical contexts. Furthermore, other authors' views concerning the essential difficulties with these concepts that may arise if publications on bioplasma were treated in terms of standard publications in science are presented.

This "standard" approach may often have led to a conclusion that a possible connection between plasma and the living state is not worth of being paid attention to. Accepting most of the charges already brought by the critics, it has been shown that the assumption of the existence of plasma state in biosystems is sufficiently justified by the well-established scientific data. If such a starting point can be accepted, i. e. physical plasma may exist in biosystems, then the road to the investigation of its biological roles may be opened, and essentially new knowledge of the living world may be gained. However, the necessary condition of reaching the first of the above scientific goals is to draw implications from this hypothesis that may be empirically tested. One can expect that new methods will be developed to provide quantitative characterization of physical plasma in biosystems. The last basic goals set for this study is to show that the concept of bioplasma is intertwined with ontological and epistemological issues of the living systems, i.e. the nature of the living systems (ontology), the ways of describing and explaining them (epistemology and methodology). Taking this into consideration, the issues of bioplasma may be considered as a problem for the philosophy of science (William R. Stroeger, Michał Heller).

The goals mentioned above are gradually discussed in eight chapters. The first four paint the picture of the status quo in research of the bioplasma and related concepts. In the Chapter 1, the historical context of the problem of plasma as the state of matter, specific in relation to the other three states, as well as the conditions necessary for the existence of plasma, its properties and abundance in the Universe is discussed. In Chapters 2 and 3, the concepts of bioplasma as formulated by Sedlak and Inyushin were characterized. This was done according to a natural sequence of questions that may be asked: what, according to these authors, is bioplasma, what properties does it have? and what role may it play in biosystems?

The next chapter presents an overview of the scientific arguments used by Sedlak and Inyushin to justify their claims, as well as the arguments that may be considered as belonging to the realm of meta-disciplinary considerations. The latter ones boil down to showing the theoretical (Sedlak) and/or practical (Inyushin) usefulness of these concepts.

The works by Sedlak on bioelectronics and, indirectly, on bioplasma were sharply criticized. The criticism often contained implicit or explicit label of pseudoscience. These charges were put here together and categorized. As was mentioned above, many of the charges were not baseless. However, it may not be accepted that these publications belong to pseudoscience. In order to refute these claims, the standards of scientific, para- and pseudoscientific endeavours are reviewed and characterized. It has been shown that it is false to include Sedlak's publications to the above category. It does not also mean, however, that they belong to either the second or - what is more important – the first one. As they in many respects do not conform to the present standards of scientific publications, a new category of the publications essentially tied to scientific publications is proposed. It is called *the crippled* or – phrasing it less negatively – *the disadvantaged scientific publications*. The works in this category differ form the standard ones because of breaking one or more rules that are considered essential by the renown book and journal editors.

It is also shown how Sedlak tried to win supporters for his concept, and to respond to the criticism by taking advantage of various rhetorical techniques.

One of the means Sedlak used was a metaphor. By citing many passages of his writing it has been shown that if they are considered from the heuristic point of view in science, many of his texts may be considered as various exemplifications of the metaphor stating that *life is plasma* or putting it in more words: *the living state is a specific plasma state*. The conclusion of this chapter underscores the assumption that the use of metaphor in science should not be considered wrong. However, one has to be aware of the fact that although a scientific novelty may stem from a metaphor (which may be placed in the so-called discovery context), it should be followed by the stages of adding precision to it (sometimes even changing it). This, in turn, should be followed by

the process of forming hypotheses, testing them, and placing them in the broader context of a theory, what usually leads to formalizing of the relationships between the elements of the theory.

If the results of the Sedlak's efforts were to only formulate and present the above hypothesis (which may be considered as the present-time form of the ancient metaphor: *life is fire*), this alone should be considered as his positive contribution to science. Yet, there is a necessary condition for it: the active presence of physical plasma and/or bioplasma must be proven.

To show that the above task is not impossible, Chapter 6 contains the arguments for the existence of physical plasma in living systems. They are: (1) the occurrence of mobile and charged particles; (2) these particles meet the criteria to consider them to be in a plasma state. The experiments showing the possible occurrence of plasma are also presented. The experiments that support the claim (1) are those in which a physical response characteristic of plasma is detected. The claim (2) seems to be supported by the experiments involving stimulating or decoupling of the life processes by the agents that increase the so called Debye-Hückel number of plasma in a structure (stimulation) or decrease it.

To make these attempts more viable, many specific questions must be answered (or even guessed) first. They are, among others: what type of plasma (classical or quantum) is sought for? Is the plasma in biosystems one continuous medium or is it a collection of individual plasma units contacting each other? Is the plasma in a stable state or does it cease to exist at a certain time? In what way is the plasma state related to the origins of the individual organism or the origins of life on the Earth? Are the properties of plasma dependent on the phase of life or an individual's state of health? Are the features of plasma evolutionary diversified in biosystems? And, finally: what internal functions may plasma play in organisms as well as in making a link between them and external factors?

Although hypothesis of the plasma in biostructures has been a new idea in biophysics, in the philosophical reflection on the nature of the Universe (and the life that inhabits it), several doctrines, ancient and modern ones, have been identified in the Chapter 7 that are very interesting because of their relationships to the concept of bioplasma. They are: The doctrine of pneuma in the ancient school of Old Stoa, a thorough biologistic concept of *plasmatics* proposed by Raoul H. Francė, and the concept of t-bioplasma formulated by Tadeusz Teller, openly relating to Sedlak's propositions. In the case of philosophers of Stoa, it has been shown that there are parallelisms between pneuma and bioplasma, as far as their subtlety, primordiality, co-existence with other elements, universal occurrence and fundamental role played in biosystems are considered. Francė's claims of biological plasma as essential component of every living being are not related to physics. Yet they pertain to a bioplasma specifically understood. Its specificity does not lie in the peculiar type of mate-

rial (it is composed of common "elements of life") but in the infinite number of connections between them rendering its infinite degree of complication. The author believes that the influence of the philosophy of Ernst Haeckel is visible, especially on the wisdom and beauty of Nature, which culminated in his monism.

The proposal of t-bioplasma may be considered as an original concept developed by Sedlak with added vitalistic and cosmological views by Teller. Certainly, it is a very interesting vision. Although it does contain scientific and philosophical elements, it should be classified as belonging to a general worldview but to neither science nor philosophy.

In the last chapter, the ontological, epistemological and methodological aspects of the abovementioned concepts are analyzed. The ontological assessment of the nature of complex systems is presented. Then the basic methods of describing them and investigative strategies used in that processes were given consideration. In these three domains, two basic approaches are identified and more closely scrutinized. They either rank higher the units that are simpler, less complex or those that are complex.

Having thus six possible attitudes to the complex systems, it is not possible to establish simple correspondences between these domains. For example, one may accept a reductionist strategy, or epistemological reductionism, yet at the same time take an ontological position that the organism is a complex whole, the properties of parts fully realized only when functioning in this intact whole. The philosophical views of Sedlak may be classified as mechanistic, reductionist, and even monistic. If, however, a broader context of Sedlak's activity is taken into consideration, one has to concede that he was not a monist. Instead, he accepted a naturalistic epistemology. Inyushin’s views have been considered as holistic and antireductionist. Francė's and Teller's approaches may be described as biological reductionism and vitalism, respectively. The latter one seems to be very close to the ideology of the New Age. The last part of this Chapter is devoted to the possible role the hypothesis of plasma in biosystems may play in the attempts of synthesizing life (AL-program).