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The Problem of Truth in Biology: Levels of Reflexive Analysis

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Abstract

The problem of objectivity or truth of scientific knowledge is understood in science as a complex of questions of a theoretical, philosophical-scientific, and philosophical nature. The basis of the analysis is the allocation of hierarchical levels of reflexive awareness of the problem of truth, different in degree of abstraction, each of which uses specific methodological tools of analysis that have developed in science. In biology, there are several levels of reflexive awareness of the truth of knowledge. Theoretical – a method of evaluating the truth of a particular theory, which is formed in different ways in classical and non-classical science. In classical science, the theory has an individual character – the initial empirical material for each researcher is different, so the true, from the point of view of each researcher, is the model he built, which, as he believes, fixes the object in reality "by itself". In non-classical science, the theory is universal and the question of truth is asked to theoretical constructions that have not yet been empirically confirmed. For example, a "gene" was a hypothetical construct until empirical evidence for its existence was found. Philosophical-scientific-reflection on the corresponding theory of truth, accepted by scientists at the theoretical level of reflection. The question of the direct comparison of elements of knowledge and objects of reality is a big problem that is discussed in the philosophy of science. The possibility of identifying the correspondence of knowledge and object is questioned, since it turns out that we cannot go beyond our knowledge of the object and oppose the object to knowledge. Metatheoretical – a choice between two or more theoretical concepts for truth. As an example, the confrontation between classical biology and non-classical (genetics) in the 1900s – 1960s can be considered a situation of philosophical choice.

Keywords: the problem of truth, levels of analysis, individual level, theoretical level, philosophical and scientific level, meta-theoretical level.

In the modern philosophy of science, science is understood as a system with reflection. V.A. Lectorsky and V.S. Shvyrev write: "The study of the nature of scientific knowledge, its mechanisms and processes, to the extent that they are also an element of science and are carried out by its means and methods, acts as a way of self-awareness of science. Using

traditional philosophical terminology, they can be called reflection on science" [1], p.7]. Accordingly, scientific reflection appears as a complexly organized hierarchical system, including many levels of reflexive awareness of philosophical, epistemological, methodological, and scientific problems. In this connection, as a method of analyzing traditional epistemological problems of science, including the problem of truth, it is advisable to use the allocation of levels and types of reflexive awareness of them in science using specific methodological means of analysis at each level [1][2]. In this regard, the problem of the objectivity or truth of scientific knowledge is understood in science as a complex of issues of a theoretical, philosophical, scientific, and philosophical nature. As an object of consideration, we have chosen biological knowledge, which represents a fairly wide range of different levels of reflexive awareness of the problem of truth within the framework of classical and non-classical types of science. There are several levels of scientific reflection on the truth of knowledge: theoretical – as a way for scientists to assess the truth of a particular theory, philosophical-scientific – as a reflection on the corresponding theory of truth accepted by scientists at the theoretical level of reflection, as well as metatheoretical (philosophical) – as a choice between two or more theoretical concepts on the subject of truth.

Theoretical level. This is a specific type of reflexive analysis aimed at finding out the correspondence of knowledge about an object to an object. This idea took shape as a correspondent theory of truth: knowledge is true if it corresponds to reality. Both problems – the reality of the mental constructions created by people and the truth of the knowledge available to people - are devoted to establishing the connection between knowledge and reality, which has a reflexively symmetrical character, since it is our reflection that turns either knowledge or reality into a referent of the problem. In one case, we ask about the truth of knowledge (whether it corresponds to reality), and in the other about reality (whether what we have conceived and theoretically constructed really exists) [3].

To be true for biological knowledge in the context of this level means to correspond to the object of reality – "the object itself". Biological knowledge (object characteristics) in this case is interpreted as something directly given to the subject in observation and experiment, therefore, the scientist believes that knowledge can be directly compared with the object itself [4]. It should be noted that biological knowledge [4] appears as a set of taxonomic objects, which correspond to many different features obtained in the course of research activities. This picture is well illustrated by the "layer cake of Odum" [5], in which biological knowledge is presented in the form of a layer cake, where one can distinguish "slices" – taxonomic sciences that set the reference of knowledge, and "layers" – fundamental sciences that set the methods of studying biological objects. In this regard, biological taxonomy appears as a basic biological science that defines referent objects, with respect to which questions about reality and truth are raised.

There are two types of theory – classical (empirical) and non-classical (mature), in which the question of the truth of knowledge is solved in different ways. The classical scientist believes that he works empirically with an object that exists objectively in nature, regardless of the researcher. The classical tradition currently takes place both in Russian science and in the West [6][7][8][9][10][11]. Here, for example, is what M. Textor writes: "In some experiences, we are aware of the object and how the limits of our receptivity affect our experience. If this idea is correct, then things are given to us as independent of the mind before we acquire the corresponding concept of an object independent of the mind. Thus, both humans and animals can have an objective experience. Therefore, they perceive the world as containing stable, mind-

independent objects. A picture of the world containing details independent of consciousness with “biographies” is our natural starting point, because this is how we perceive the world. Revisionist metaphysics, which dispenses with objects of this kind, does not deserve faith, because it does not agree with our experience of the world” [7]:891]. In our opinion, Textor misses an important point in the described scheme of perception: a person perceives, as a rule, not single objects, but classes of objects – taxa fixed by general concepts – universals that form the basis of human language. A taxon is a theoretical object, therefore, it is hardly correct to believe that it is possible to “directly” perceive objects, that is, as “independent of the mind”.

Thus, a classical scientist believes that he works empirically with an object (taxon) that exists objectively in nature, regardless of the researcher, therefore, if it is necessary to evaluate knowledge for truth, he believes that it was he who “saw” the object correctly, whereas the predecessors were mistaken, therefore the previous theory is not considered as true and the empirical taxonomic research underlying the previous theory turns out to be incomplete and is resumed in the research of a subsequent scientist, leading to the identification of new essential features in individuals of the taxon and the construction of a new taxonomic theory, etc. Knowledge about the same objects turns out to be unstable, and, consequently, the question arises about its truth [3][4].

Since in empirical theory objects exist from the point of view of biologists-taxonomists independently of the act of cognition, the theory is only an auxiliary tool for the detection of natural objects. A natural object, the biologist believes, is real a priori, because it is “natural”, so if it is “correctly isolated”, then the question of the reality of the object and the truth of knowledge about it disappears. Accordingly, the question of truth is asked to knowledge constructions (models) that are considered erroneous, which often leads, ultimately, to the exclusion of the object from the ontology. Ontology is assumed to coincide with the “most objective reality” at least in the future, therefore, it is formed in the process of constantly arising problems of correspondence of a multitude of empirically confirmed models in the studies of various scientists to the “most objective reality”, and since each researcher has his own source empirical material, then the true one, from the point of view of each researcher, turns out to be built by him a model that, as he believes, captures the object in reality “by itself” [12].

The non-classical theory of biology is understood by us on the model of non-classical physics, which was formed after the quantum mechanical revolution in physics. Such a theory is constructed with respect to ideal objects such as a “material point”, “absolutely solid body”, etc. In biology, the ideal object of this type is a “fene”, the material analogue of which is a theoretical object – a “gene” [13]. The revolution in quantum physics radically changed classical ideas about the nature of truth: the truth of knowledge is considered relative to cultural means of cognition (language, theories, models, devices). Unlike empirical theory, which has an individual character, mature theory has a universal character, i.e. it is accepted by the majority of scientists, and the question of truth is asked to theoretical constructions that have not yet been empirically confirmed, therefore there is a direct connection of theoretical models with the system of empirical knowledge, the models themselves function mainly as an explanation of empirical knowledge, for which the language of mathematical formulas is used. For example, the “gene” was a hypothetical construct until empirical confirmation of its existence was found. Therefore, if in non-classical biology the question of reality is resolved affirmatively, then the theoretical model falls into the ontology of science and is assigned the status of true [14].

Philosophical and scientific level. The question of direct comparison of the elements of knowledge and the objects of reality is a big problem that is discussed in the philosophy of science. Here is what Sapunov M.B. writes about this: "The objective reality of science, the immanent property of which is objectivity (objectness), turns out, in classical language, to be "transcendentally ideal" - an ideal component of the activity of a practical subject. (This train of thought can be traced, but on an idealistic basis, in classical German philosophy). That is why the objectivity of the characteristics of "nature" cannot be understood fetishistically: it is ensured precisely by the objectivity of practice" [\[\[15\]:4-5\]](#). Naturally, within the framework of the theoretical level of reflection, it is usually difficult for a scientist to understand the reasons for the instability of scientific knowledge and the problem of its truth. At this level, empirical activity is carried out with respect to objects, followed by their description, which is assumed to be true due to the initial installation on the direct fixation of the object in reality itself.

In the case of the classical theory of biology, the problem of truth takes on the most acute character, since the theoretical activity of a biologist-taxonomist is of an individual nature, which is why each researcher has his own ideas about the features of the object (taxon), which often do not coincide with the ideas of other scientists. In non-classical theory, the problem of truth is smoothed out by virtue of the acceptance of theoretical propositions by the entire scientific community, and arises in cases when a generally accepted theory does not work due to the presence of limits of its applicability. In both cases, there are difficulties in adequately understanding the causes of the truth problem. Awareness of the essence of the truth problem occurs in the philosophy of science in the form of an attempt to identify how to understand that knowledge and object correspond to each other. "According to the classical trend," wrote Tadeusz Kotarbinski, "what is true is what corresponds to reality" [\[\[16\]:292-293\]](#). Explaining the concept of "correspondence", Kotarbinsky stops at the following interpretation: "Jan always and only then thinks truly when Jan thinks that things are this way and that, and if things are this way and that way" [\[\[16\]:292-293\]](#).

But, what does it mean that things are so and so? Rozov M.A. reveals the socio-cultural context in establishing the truth of knowledge, giving many examples of when knowledge turns out to be relative to cultural means of cognition. This feature of knowledge was revealed by non-classical science, which arose after the scientific revolution in physics and the development of quantum mechanics, one of the consequences of which was the idea of the relativity of knowledge to culture. This view casts doubt on the possibility of identifying the correspondence of knowledge and the object, since it turns out that we cannot go beyond our knowledge of the object and contrast the object with knowledge. This often leads to the rejection of the correspondent theory of truth. M.A. Rozov notes that there is a way to preserve the correspondent theory of truth – considering it within the framework of the activity concept of cognition. Here is what he writes about this: "The knowledge of "P" is true if and only if, after performing these procedures, we have received what is indicated in "P" [\[\[17\]:149\]](#).

Thus, according to M.A. Rozov, the object of our cognition is human activity, which we ourselves create and reproduce. Since our knowledge is a description of activities, we can solve the problem of their correspondence to the object of knowledge and thereby accept the correspondent theory of truth. However, he further notes: "in this case, our capabilities are limited by the principle of complementarity. An accurate description of the activity leads to idealization, which means

that the knowledge obtained in this way is not really applicable anywhere. And their practical application, which still takes place, does not obey any strict rules and is based on the reproduction of numerous samples. In other words, the conditions for the truth of our knowledge, their comparison with real activity, are determined not at the level of rational reasoning, but ultimately at the level of social relays. If we return to the language of M. Polani, which is convenient in order to emphasize the paradoxical situation in this case, then our thesis will look like this: the conditions for the truth of explicit knowledge are given to us at the level of implicit knowledge" [\[\[18\]: 248\]](#).

Metatheoretical level. The philosophical situation of choosing between theoretical concepts can be illustrated by the example of the confrontation between classical biology and non-classical (genetics). The situation in biology at the end of the XIX – beginning of the XX century was quite complicated – on the one hand, it was a situation of choice between classical ideas about heredity and non-classical ones, which were proposed by G. Mendel. On the other hand, the ideas of heredity were closely related to Darwin's theory of evolution, Ch. Darwin published his book "The Origin of Species" in 1859, when there were still classical ideas about heredity. G. Mendel published his ideas about heredity later – in 1865 and they were not accepted by his contemporaries. Therefore, Darwin's theory faced great difficulties, which Darwin never managed to overcome [\[19\]](#). G. Mendel's theory also faced the need to overcome classical ideas about heredity. When G. Mendel unveiled his concept, it was not accepted by contemporaries as insufficiently substantiated. After the unsuccessful report in Brunn, Mendel wrote a letter to C. Negeli, who was one of the most authoritative scientists of that time. Negeli perceived Mendel's experiments as incomplete and suggested that he conduct similar experiments with plants of the genus *Hieracium* [\[20\]](#).

However, following the recommendations of C. Negeli, G. Mendel did not receive confirmation of his assumptions. In experiments with the hawk (*Hieracium*), he encountered difficulties in obtaining hybrid plants, so he received a few hybrids of the first generation, in which he noted not uniformity, but splitting of signs by the color of the flower. The second generation turned out to be uniform and the plants were entirely similar to the hybrids of the first generation from which they originated. As a result, the results obtained on the plants of the hawk were, at first glance, contrary to the laws of dominance and splitting discovered on pea plants. Mendel could not explain this paradox, because he did not know the peculiarities of the sexual process in a hawk. It is now known that this genus has a special type of reproduction – apomixis, therefore, plants of the genus hawk have deviations from the norm in the sexual process.

Thus, on the one hand, the social scientific activity of biologists of that time contradicted G. Mendel's ideas, on the other hand, the real situation with the inheritance of traits in plants turned out to be more complicated than G. Mendel had assumed. Mendel's contemporaries worked in the traditions of classical science, while Mendel laid the foundations of non-classical biology long before the development of non-classical physics. Only 35 years later, Mendel's ideas begin to receive confirmation in the works of foreign and domestic scientists, of which the works of N.I. Vavilov occupy a large place. The situation in the USSR, which can be described as a situation of confrontation between classical biology and genetics, is connected with the name of Vavilov. At the same time, Darwinism, after the revival of G. Mendel's ideas, did not receive the necessary confirmation of the reality of natural selection, since it was geneticists who established that mutations – hereditary deviations from the norm, which biologists believed to be the material for natural selection and

evolution – are in most cases not viable. This gave reason to many biologists to deny Darwinian evolution until the early 1960s, when the work of S.S. Chetverikov, first published in 1926, was recognized [21][22].

Thus, in general, the processes that took place in the world community of biologists are exactly the situation when the socio–historical practice of scientists, continuing from the early 1900s until the end of the XX century revealed the advantages of genetics compared with the classical tradition in biology. The situation of philosophical choice between classical and non-classical traditions took place not only in biology, but also in physics [14].

Conclusion

The problem of the objectivity or truth of scientific knowledge is understood in science as a complex of issues of a theoretical, philosophical, scientific, and philosophical nature. The analysis is based on the identification of hierarchical levels of reflexive awareness of the problem of truth, different in degree of abstraction, each of which uses specific methodological means of analysis that have developed in science. In biology, there are several levels of reflexive awareness of the truth of knowledge:

- Theoretical – a way of assessing the truth of a particular theory, which is formed in various ways in classical and non-classical science. In classical science, the theory has an individual character – each researcher has his own source empirical material, therefore, from the point of view of each researcher, the model he built turns out to be true, which, as he believes, fixes the object in reality "by itself". In non-classical science, the theory is universal, and the question of truth is asked to theoretical constructions that have not yet been empirically confirmed. For example, the "gene" was a hypothetical construct until empirical confirmation of its existence was found.
- Philosophical-scientific – reflection on the corresponding theory of truth accepted by scientists at the theoretical level of reflection. The question of direct comparison of the elements of knowledge and the objects of reality is a big problem that is discussed in the philosophy of science. The socio-cultural context is revealed in establishing the truth of knowledge, when knowledge turns out to be relative to cultural means of cognition. This feature of knowledge was revealed by non-classical science, which arose after the scientific revolution in physics and the development of quantum mechanics, one of the consequences of which was the idea of the relativity of knowledge to culture. This view casts doubt on the possibility of identifying the correspondence of knowledge and the object, since it turns out that we cannot go beyond our knowledge of the object and contrast the object with knowledge. This often leads to the rejection of the correspondent theory of truth. The way to preserve the correspondent theory of truth is to consider it within the framework of the activity concept of cognition.
- Metatheoretical – a choice between two or more theoretical concepts on the subject of truth. The Marxist principle of the unity of theory and practice assumes that a theory must undergo a long practical testing for its truth. In this sense, socio-historical practice is a "court of History" that reveals the truth of theoretical propositions. An example is the confrontation between classical biology and non-classical (genetics) in the 1900s – 1960s, which can be considered a situation of philosophical choice.

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