

THE NATURE OF LIFE - ORGANIZATION'S ASPECT

S. Zięba

Catholic University of Lublin, Al. Raławickie 14, 20-950 Lublin, Poland

A b s t r a c t. The present paper aims at showing that in the explanation of the nature of life two types of approach should be allowed: phenomenological and symbolic. The first is based on causativity, and the second on generalization.

K e y w o r d s: origin of life, nature of life

The question, what the life really is, has been actual for centuries. It's been dominating one since ancient Greece up to the contemporaneity. The difference between the living hand and the made of bronze one, has been interested for us today as well as for Aristotle in the past. This difference is a criterion of - suitable - rejection or acceptation of the autonomy of biotic reality. Ancient Greeks, looking for the answer, had traced out three main ways, human thought had been connected with. These are: the way of theological finality, the reductionistic one, and the way on which the key for the reality shall be an event. Following that, the main points of temporary theories of life are: mechanism, holism, finalism, event, determinism and indeterminism. We are enclosed at the pool of conceptions, none of which has been accepted on the level both of philosophy, as well as of the natural sciences.

Are we hence sacrificed to such the variety? Why, from the methodological and epistemological point of view, cannot we find the only definition of life? Why can not we accept the uniform research strategy of animate systems? Are we able to shape the uniform picture of the nature? Where is the difficulty in discovering

the organizational algorithms of animate systems? Why can not we compare the systems of biotic and abiotic nature? What is the difference between the world of biological beings and the physical universe?

We will not answer all these questions. We only do want to sign some sets of conditions connected with these problems. We will do it in two aspects: the methodological and subjectable ones.

DIFFICULTIES IN CHOICING THE RESEARCH STRATEGY OF ANIMATE SYSTEMS

The possible choice of researches concerns to the strategy of analysis or strategy of holism (decomposition or composition, element or system).

There are some trials of constructing another one strategy - compositional one. Without analysing the details, let's point what is this choice depended on. The simple answer should be: the choice depends on defined conception of science. But this choice isn't as simple. It's been related to the context of discovering and reasoning, and both these factors depend on culture. In such the case we come to an agreement, that there exist no "only" facts, but picturing and explaining them is possible only on the ground of methodological and epistemological categories (for example: the choice of the criterion of authenticity).

The choice of reductionistic or non-reductionistic strategy has been a consequence of culture (for example scientific one) and of the accepted philosophical vision of the world (monism, pluralism). The likings of two scientists of different specialisations must be different too. The final choice of research strategy follows many non-scientific factors which have been connected with the basic vision of the world and political, ethical or moral behaviour. Jacques Monod wrote: "biology imprints its sign at all the domains of human life; philosophical, religious, political ones [...] ethics and cognition have been definitely connected through the actions. Every action exists in a special conditions, has been used to enforce any values or has been directed against them; has been a choice of value" (*Necessity and the accident*, Warszawa 1979).

So, the choice of life nature's research strategy depends both on scientific and non-scientific factors. Let's take into account for example achievements of molecular biology. The theory of life, constructed on the basis of this branch, induces the real powerful non-scientific ideology. Monod says: "this, what wasn't possible for Descartes, is possible for us. The man steers the machines, so why wouldn't do it the gene?" What really goes on? On the objective knowledge or on any of models of theory?

The basis of analytic strategy is the reductionism. It's been used not only in biology, but in psychology or sociology too. What connects reductionisms of all the forms, this is accepting as rightful and sufficient this, what reduces the whole to a part and what assumes the relations between the parts and the whole as equally to the same level. Let's point, that the methods of reductionism come not from biology; it's been known since Wilhelm Ockham, through Laplace, up to present.

Let's point any important elements of reductionism:

a) constitutive reductionism - every biological phenomenon (a fact or process) is a consequence of physical and chemical phenomenon. None of biological phenomena may stay in a conflict with the physical or chemical (nuclear or atomic) reasoning;

b) explicable reductionism - every biological phenomenon may be understood in the convention of the behaviour and interactions of its own elements;

c) theoretical reductionism - laws and theories of biology may be reduced to laws and theories of physics and chemistry; this is the way to uniformity of science and to the unified picture of the structures of universe.

Let's estimate this strategy. The time of extreme version of reductionism is passing by, except of still countable value of reductionism itself. One asserts, that such the method is not sufficient enough to allow the recognition of world's organization. This problem has been picked up not by biologists, but by physicists. Roger Penrose (*Emperor's New Mind*, Warszawa 1995) maintains, that our physical knowledge has been not complete, especially in the area related to life, thinking and consciousness. So, what are these special features of biological systems, except of the historical evolution and the fact, that, definitely, we are such the same ones? These features allow the animate systems - contrary to the other objects - to reach the level of intentionality and semantics.

Let's call another one Penrose's paradigm. Each two physical particles, like - for example - electrons, have been always identical ones. If the positions of electrons from human brain and the brick had been reversed, the whole system wouldn't indicate any change of its state. Such the change wouldn't be observed in the case of reversion of all the other particles, like protons or neutrons. One might assert, that, in fact, nothing happened. The difference between the man and the brick from the wall of his house is not compared with the identity of separate particles only.

Now we come to the main problem of life's researches; the logical system of animate creation. Perhaps the algorithms of such the logic may be very simple or very complicated. In any case, first of all one shall solve the problems of cognition, like: correlation of biological organs, integration of processes, succession in phases of order and so on. The main question which follows these problems is the nature of organization's

algorithm. In the case of biological systems, one expects the biological algorithm.

The doctrine of emergentism seems to be the trial of connecting the reductionism and anti-reductionism. One of the nature's features is the ability of connecting elements into the new object of the new features, which are not a simple sum of the features of elements (for example, the result of connecting the hydrogen and oxygen may be water, features of what are quite different than hydrogen's and oxygen's ones). The doctrine of emergentism may be used for indicating biological phenomena as the new ones, both in psychological and theoretical sense. This procedure isn't easy, because of the fact, that behaviour of the whole system cannot be understood as the sum or combination of its separate parts. This strategy has been discussed by methodologists.

Thinking about the logic of animate systems, one shouldn't forget, that every structure constituting the system hasn't been being constructed at once. Hence, the use of reductionistic strategy finds any difficulties, both on the level of animate system's mechanisms, as well as in relation to the molecules. In this context one must think about the problem, how the natural selection might be reduced to the separate laws of physics and chemistry. In other words, it's hard to find the dependencies of the biological functions and chemical or physical properties of molecules. Understanding of life means not only taking into account the outer empirical features, but inner properties too.

Reductionism leads to the difficulties both on the level of the system and on the level of population or the whole ecosystem. They have the sources in the set of primary biological or ecological assumptions and boundary conditions. Further, one cannot construct the theory of life's nature without taking into account the temporary picture of the world and its development. The shape of all the biotic systems is a consequence of wider conceptions.

It seems, that one should accept at least two types of explications, which wouldn't be reducible to themselves. Except of the phenomenological way of explaining, one shall accept

the other way, "symbolical" one (i.e., relating to the biosystems only). The reason for such the methodology arises from observations of animate systems and their biological, chemical and physical properties. Such the explanations may be led from: 1) the separate processes, 2) the holistic structure. The need of "symbolical" explanations follows the possibility of picturing the phenomena by the help of the chain of symbols, appropriate to the separate system's actions. For example, the organism may be characterized by some regularities, which are able to be pictured by appropriate symbols. Of course, one may dispute, is that explication useful enough or isn't. The situation would be much simpler if the scientists hadn't recognized reductionistic way of explanation as insufficient. But, except of the 150-years-old use of this strategy, its paradigm seems to be not good enough for explaining the problem of life's nature.

The limitations of reductionistic method had forced the scientists for looking for other research strategies, for example holistic ones. In the process of discovering the autonomy of animate systems, one shall take into account the role of observer, the phenomena which might be both connected and interpreted. The autonomy consist: understanding the biological phenomena, reflection on the evolution, steady relations, which constitute the unity of life and secure continuing its identity. In this context there appears the new problem of properties, relations and nature of processes. Barry Commoner asserts, that biologists, comparing the organizational levels (from chemistry of the separate cells, up to the whole ecosystems), say, that they all have been being included one into another, like the boxes. The last one box stays opened. In the opinion of Crick and Watson, the smallest box should have the primary reasons of the animate system's properties inside. But this box seems to be empty, so the feature of heredity of life seems to be the life itself. Before looking for the contents of the box, let's point another theoretical question connected with probability.

The discussion on the origin and development of life has been very often connected with

the question of probabilistic event, understood as the organising factor. One oughtn't to compare the probabilistic model of life with the finalistic one. Acceptation of event understood as organising power implies what follows: 1) in the sufficient long period of time, this what was impossible, comes to be possible, 2) animate organisms are like the machines, 3) the world is a queue of extremely improbable phenomena, 4) arising the animate organisms is a consequence of thousands and thousands of events, 5) the probabilistic event makes the verification less useful, 6) the event excludes possibility. Deciding to this probabilistic approach, one shall be conscious the specific way of interpreting the biological phenomena, especially compared to their genesis and importance (sense of functioning).

In the opinion of scientists who go this way, the events are conformable with the experiment. In this moment one must ask such the question: is an event the element of the empirical data's set or may be are these data the same as events? One may assume that the life is so impossible, that it may be explained in the aspect of probability only. But perhaps one may suggest another one hypothesis? Is the hypothesis of probabilistic event verifiable at all on the ground of biological or physical data? Are we allowed to explain anything by event? At present, the hypothesis of probabilistic event isn't verifiable, but it seems to be scientifically insufficient.

THE ORIGIN AND NATURE OF LIFE

At the present stage, all the theories of life seem to be insufficient. It's a consequence of the questions, which have been induced in the process of scientific increase. Except of this, in explanations of phenomena, we usually want to use the whole human knowledge from all the branches of science (physics, chemistry, cybernetics and so on). Hence we have some problems of methodological nature, connected with the need of uniformity of objects (methods, definitions, interpretations) taken from different branches of science. Then we do construct once a homogeneous theory of the universe, inclu-

ding the life, another time - the special, separate theory of life. In fact, the matter of which all the animate organisms have been built, is the same kind as the rest of the matter in the world, but there's organizational quality, which makes it different from the physical matter (the living hand and the hand made of bronze). So we cannot decide what the life is: the feature, the process or the condition. All the definitions, depended both on one and, as well, many variables (functional or substrative ones), seem to be insufficient. Connecting this with the methodological and epistemological difficulties, we have got the real complicated scientific situation. Let's point some of main difficulties from this set of problems, taking into account two aspects: 1) origin of life, 2) nature of life (let's give up the discussed problem of evolution).

Origin of life

We want to show, that the difficulties which appear on the stage of genesis, imply consequences into the conception of life's nature. The most important problem in this set is transformation from physis to bios. This is the transformation from minerals to animate systems. This question must be solved as an element of the theory of world's complexity - from cosmic scale to the biological one, from the condition of no characteristic features, through the physical systems, up to the biological ones. Theory of complexity should consist the organization in both functional and structural dimension (how are the structures responsible for the functions). One may reduce this problem to aspects: 1) the origin of the first animate system, 2) a moment of being started to be animate. To answer first of the questions, we use the paradigm of probability. Let's estimate the chance of existence of - for example - amino-acids or nucleic acids. As the result we've got very small numbers. For example, the probability of self existence (as the result of the event) of the molecule with 0.9-assembly is equal to the chance of finding the only one separate atom in the universe by the first trial ($1/10^{235}$). Answering the second question, we assume, that there exist the strict

connection between the physical universe and biological one. Its existence is not the negation of radical change - life is a process divercely to the trend of universe's increase. This knowledge lets us to limit to the Earth's system only. In this system we may try to answer how biochemical dimension of life implies the biological one. The opinions on it have been different. In Harry's mind neither biochemistry, nor palaeontology may explain how the unanimate systems come to be the biotic ones. In opinion of Steven Rose and Sarah Bullock (*Chemistry of life*), there doesn't exist any sharp border between unanimate and animate systems. This doesn't reduce the life to the level of physics or chemistry. The principles of biology constitute the organizational relations between the macromolecules, cells and organisms. Each animate system has got its own history: biochemical, evolutionary or developable. The biochemist's target is: understanding vital functions only on one of possible levels (one shall remember, that present biochemistry uses the knowledge of XIXth century physics and chemistry). Let's add, that for Freeman Dyson (*Beginning of life*), the question of origin of life arises from biology, connects to a problem of creating the biological organization (what's a consequence of reproduction and metabolism).

Since the 50th, the problem of the origin of life, has been interpreted at the molecular level (replication and existence of genetic code). The aim of it shall be the explanation of the specific functions in molecular aspect. The result of such the researches is the statement, that origin of life may be interpreted in range of *bouillon de culture*, the global complexity, which could show explicit the emergency of biological structures. The complexity shall be understood not as the set of elements, which determine origin of life, like for example water or chemical substrata, but integrability of all the physical and cosmic conditions. The life's existence is an element of complex evolution, not the result of complexity of elements. The first question, one shall be reasoned, is demonstration, that the complexity is able to create the cell. Was this process obligatory? What was the reason for it? Where

are the sources of such the process? The existence in organization is one question, the second one is securing it. Now we have another one problem: which of the elements have been responsible for order, information, organization and complexity (categories appropriate to biotic and abiotic systems)? If science is able to understand the biological systems, one will be able to explain the nature of life. Solving these problems has been connected with constructivism, which probably has been related to the principle of emergency, appearance of the organization of organisms. In this context the life would be the result of molecular emergency.

Nature of life.

The talk on the nature of life, often aims to simplification of biological reality or to making it responsible for the properties without empirical sense. The question on life's nature has been opened at present stage and many of basic biological mechanisms need to be invastigated. At present, it seems, we are about to find the organizational algorithms of animate systems, its inner logic. We haven't yet constructed the general theory of life, which could be related to two of aspects: historical (but not the history of discoveries) and present ones. In the historical view, we see difficulties of different kind related to the problem of evolutionary mechanisms. This situation is well-known from the literature, we are going to pass it this time. In the present aspect, we have to solve a very complicated equation: life = auto-, geno-, pheno-, ego-, eco-, reorganization (computable, informational and comunicational one). The essence of this equation is, that the vector of life's increase has been directed to the life itself. Organization of animate systems concerns the areas of physics and psychology, chemical reactions and ecosystems.

There was a hope, that phenomena from the area of molecular biology may finally explain the nature of life (the researches concerned mechanism of heredity, genetic code and information), thanks to the linear, one-dimensional structure of information. This conception leads to some serious difficulties. It limits the life to

the area of genetics and forces molecular biology to accept non-linear structure of gene. There wait for solving such the problems like: mechanisms of cell's control and regulation processes, subtle elements of its structure, cell's functioning (as an element of organism), biochemical mechanisms of increase, hormonal regulation, memory. This doesn't mean, that molecular biology has been not useful and hasn't been a success. The criticism is connected with faultiness of reasoning. For example, the scientists concern in connections between the protein and nucleic acids. They accept, that the order on primary level implies orders on all the higher levels too. It's not clear, what forces the scientists to classify the orders in such the way. Molecular biology is not concerning all the inner system's connections.

The present trials of solving the life's nature problem follow three directions. The existence and behaviour of animate systems may be reduced to: 1) chemical reactions (biochemistry) - the only chemistry with some aspects of physical chemistry, 2) nanoelectronics (quantum logic) - electromagnetic reactions induced by informational acts, 3) informational logic - the matter has been a result of the informational flow (perhaps matter's source might be "metainformation" ? - Popow).

We vote for the third way of researches. The singularness of life has been connected with the processes of computing, not only sending the information inside of biological system's inside. The scientists often concern in transferring, reciving and sto-ring the information in separate cells or in organs. What's this information's kind of? Cybernetic, physical or biological one? For acceptance of the third kind of information prompts us such the properties like increase, evolutions, arising of new features. There are some trials of reducing the biological information to the level of biochemistiy or electromagnetism. Main problem in this case is storing the information in human's brain; this information is not localizable. As Daniel C. Dennet (*Consciousness Explained*, New York 1991) remains, human consciousness has been the last one mystery. Consciousness is still a being,

which makes the best thinkers to be quite baffled. In the opinion of William H. Calvin (*How the brain thinks*), the trial of using the Darwin theory for explaining the mental aspect of life, has been quite aimless. In between of the quantum phenomena and consciousness, there exist about twelve steady levels of organization; for example chemical connections, self organizing molecules, molecular biology, genetics, biochemistry, cellular membranes and their ionic canals, synapses with their neurotransmitters, nerve cells, neural networks, neural segments, dynamics of the brain. The analysis of these levels and mechanisms connected with them, leads the mentioned author to the statement, that consciousness, in its multiple notations, has been localized neither in cellars of chemistry, nor in foundations of physics.

Analogic situation consists the animate systems. Here the problem connects to organizational algorithm. As George C. Williams says, biologists, who investigate evolution, have forgotten, that these investigations have been carried on two areas - material and informational ones. One cannot reduce these two views to one united level. Information has got no charge, no mass and no spacial directions. As well, the matter cannot be counted by bytes. The matter has got no conformability, no redundancy and no other categories used for information. This feature methodologically separates information and matter. In the consequence, there's a statement, that a genome is a packet of information, not the physical object. The genome may be defined by the sequeuce of basic couples of alkalies in the particle of DNA. The particle plays only the role of a carrier for the information. Without clear separation of information and carrier, it is difficult to speak about evolution and to explain the nature of life. Physical and biochemical properties sign the information. In opinion of Joseph Levine and David Suzuki (*The mystery of life*), the animate organism - orderly whirl in the river of chaos - does exist thanks to the pool of biological information's composition. The DNA is not the source power of life's development and history of Earth for three and a half billion years. This source power

is the information, hidden in particles of DNA. This information holds control on more details of each animate system, than it is possible to imagine - from unknown inner processes of cells, up to the whole number of features.

In range of this cognitive option, we shall interpret higher levels of life. One discusses the sense of such the conceptions as biosphere or ecosystem. We assume, that populations have been ordered not by accidental events, but thanks to information, being gathered in range of such populations. Information on the level of ecosystem derivates from all the individual's interactions, the individual experience and its adaptive structures. The loose of informational

packet (deadness of species) may imply perturbations or chaos in the system's dynamics.

Finally, our statement is, that organization of the animate system shall be analysed in context of three categories: matter, energy and information. Information explains the continuation of generations, shows the sense of connections inside the animate system. In this light, immanency of the system comes to be more important. Information answers the question about the reason of connecting the nucleic acids and proteins, and decides about qualifications of order. What's unknown, that's nature of information; what is the difference between the cybernetic information and biological one.