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ONTOGENESIS: A PHENOMENON AND A PROCESS (ON THE PROBLEM OF THE EVOLUTION OF ONTOGENESIS)

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Ontogenesis: a Phenomenon and a Process (on the Problem of the Evolution of Ontogenesis). Kovtun M. F. — An unconventional approach to the study and analysis of ontogenesis, based on the duality of its nature is proposed: in the first case this is a phenomenon, in second case it is a process. As a phenomenon, ontogenesis covers all manifestations of living, providing the continuity of life on all the levels of its organization, ensures lifespan of a species, regardless of the individual's life, and thus the dynamic stability of the cycle of matter and energy flows, the evolution cycles, the biosphere and life in general. As a process it is the implementation of ontogenesis by the way of successive morphogeneses. There is a gap between these components of ontogenesis (the phenomenon and the process) that must be filled out. This is a complex task in the scope of the ontogenesis evolution problem (making the theory of ontogenesis).

Key words: ontogenesis, phenomenon, process, morphogenesis, cycle of matter and energy, biologization, individualization, essence.

Онтогенез: явление и процесс (к проблеме эволюции онтогенеза). Ковтун М. Ф. — Предложен нетрадиционный подход к изучению и анализу онтогенеза, исходя из двойственности его природы: с одной стороны, это явление, с другой — процесс. Как явление онтогенез охватывает всю живую природу, обеспечивая непрерывность жизни на всех уровнях её организации; обеспечивает продолжительность жизни вида независимо от жизни индивида и тем самым динамическую стабильность круговорота вещества и потоков энергии, эволюции круговоротов, биосферы и жизни в целом. Процесс — реализация онтогенеза путём последовательных морфогенезов. Между этими составляющими онтогенеза (явление и процесс) — свободное пространство; заполнить его и представляет собой комплекс задач в рамках проблемы эволюции онтогенеза (создание теории онтогенеза).

Ключевые слова: онтогенез, явление, процесс, морфогенезы, круговорот вещества и энергии, биологизация, индивидуализация, сущность.

Introduction

The ontogenesis or individual development is the process that covers the time from the beginning to the end of the life cycle of individuals (organisms). It is divided into prenatal period or embryogenesis (prior to withdrawal from embryonic membranes) and postnatal period of development, or post embryogenesis (after leaving the embryonic membranes). The embryogenesis is an intimate process hidden from the direct observation and its study requires special methods. The studies of embryogenesis have a long history; we can find fairly complete information about the chick embryogenesis already in the works of Aristotle (384–322 BC).

Later it became apparent that the embryological studies do not provide information about the ontogenesis in general and that studying processes of individual development requires knowledge from other fields such as genetics, cytology, molecular biology, biochemistry, etc. With the involvement of these sciences, and development of the experimental trend in embryology, the classical embryology relays race to a new branch, the biology of individual development, with a wider range of tasks, including the origins and patterns of ontogenesis evolution. Until now, there is a question in focus, if the unicellular dividing can it be considered to be the ontogenesis. A. N. Severtsov (1939) denied the existence of the ontogenesis for the unicellulars, calling it the histogenesis, and A. K. Dondua (2005) was close to Severtsov's attitudes. However, most biologists studying ontogenesis expressed the opposite opinions (Smith, 1968; Dogiel, 1951; Korotkov, 1979, 1991; Desnitsky, 2006; Dovgal, 2010). In particular, I. V. Dovgal believes that "...the mechanisms of ontogenesis regulation at the cellular level in the protozoans could be a model not only for the formation of the multi-cellular mechanisms of morphogenesis (as in *Volvox*), but for the mechanisms, which are similar to those occurring in the fertilized egg in prior to cell division." G. P. Korotkova (1979) presented a selection of data, showing in her

opinion the origin of the processes that lead to reproduction and ontogenesis on the stage of chemical evolution. Of course, ontogenies of the protozoans, multicellular invertebrates and vertebrates are different, but their origins are obviously common.

Ontogenesis of all living organisms is a product of biological reproduction and morphogenesis. The fertilization and biological reproduction are starting ontogenesis (launch the process), and the morphogenesis is a tool to implement it. As already mentioned the ontogenesis cannot be understood only on the basis of embryogenesis or postembryogenesis studies.

However, we can not ignore the fact that the study of embryogenesis is almost the only source of empirical data, which shows the development of the organism before it leaves the embryonic membranes. Due to specific embryogenesis studies, we have got information about their variability (intra-and inter-specific), about the differences in the process behavior in phylogenetically closely and distantly related species, the heterochronies, heterotopias, embrionization, pedomorphosis, equifinalism, etc. Therefore, the specific embryogenesis studies still remain in demand in the XXI century, however, with the reconsidering (upgrading) of the purpose and objectives of research. The embryology, as the part of the biology of individual development, should have a general biological (theoretical) problem statement: transfering to (specific) ontogeneses origin and evolution, variability and stability through the study of specific embryogeneses, i. e., the solution of the tasks that form the basis of the theory of ontogenesis.

In this paper, we have the groundwork's of specific embryogenesis. Relying on literature data, we propose an approach to the discussion of the problem of ontogenesis, proceeding from its duality. In particular, we believe that in ontogenesis must distinguish at least two components: ontogenesis as a phenomenon and as a process.

Ontogenesis as a phenomenon and as a process

We consider ontogenesis as a phenomenon in the wide sense, akin to gravity, magnetism, radioactive emission or, finally, life, and taking into account its significant differences. If the gravity, magnetism, radiation levels, subject to the physical laws of matter are inherent in general, in case of the ontogenesis it is inherent in the living matter and, only starting from a certain level of its organization. Due to that the ontogenesis as the phenomenon covers all the animate nature, providing the continuity of the life of organisms at all levels of the organization. Process is the ontogenesis implementation by successive morphogeneses.

The ontogenesis as the process is available to study with the different methods of various sciences, including the experimental approach (the leading role remains for the embryology), the ontogenesis as the phenomenon remained out of research scope: there are no direct methods for investigation of this manifestation. It is possible to analyze, discuss, debate, based on the general scientific methods (techniques) as the extrapolation, analogy, philosophy...

The phenomenon is a philosophical category, and its dialectical pair is the essence. It is believed that the knowledge proceeds from the phenomenon (simplified — the detection of an object or thing) to the disclosure of (knowledge) its essence (internal connections and external characteristics consist the essence of the subject (Soviet..., 1984).

It is not correct to talk about the discovery of ontogenesis as a subject (if not to consider the naming of this phenomenon as "ontogenesis"): it exhibits itself in the "race relay" from generation to generation of organisms and maintaining the essential qualities of the species and has done so for millions of years and thousands of generations.

The phenomenons are not single-valued, both in origin and in time they may be "eternal", and also can be created by the nature and mind. For example, rain and lightning, tides, gravity, cosmic radiation are the "eternal" existing phenomenons. Cognition of the essence of these phenomenons has led to the creation of artificial sources of energy and devices that convert energy from one form to another, obtaining the materials with desired properties, allowed humanity to overcome the force of gravity, to get into space, to the depths of the ocean, etc.

The ontogenesis refers to the phenomenons created by nature, i. e., evolution. The time of its "creation" in general terms, obviously, coincides with the beginnings of life, and more specifically — with the beginnings of individuality.

There is a gap between these two components of ontogenesis (the phenomenon and the process) and, obviously, the filling this gap is a set of tasks in the scopes of the ontogenesis problem (a theory of ontogenesis).

Ontogenesis as a phenomenon, regardless of the length of life of the individual organism, manifests in a longer or shorter lifespan of an individual, maintaining the essential characteristics of organisms that consist this species (taxon) including the presence of variation; and diversity in a variety of the animate nature (biodiversity), and in the strong stand of the whole life on the Earth. Ontogenesis as the process manifests in the prenatal ontogenesis and its variability, time of sexual products maturation, variability of timing of organs maturation in relation to the demand for their roles in the postnatal period, types of division, cyto- and histogenesis; life of the individual organism and the embryonization.

Lifespan is obviously controlled by the cycles of matter and energy flows, and depends on the role of the species (life form) in the cycle. Therefore biosphere preserves all types of organisms with different lifespans and various functions to maintain the dynamic of the cycle. Some of them, with a short life cycle, are the operative components of the cycle, while others, with long lifespans, are reservoirs or storage of excessive energy and matter (Kovtun, 2006).

During the evolution of ontogenesis the mechanisms of its changes or modifications (restructuring) were developed. The main known changes are the changes of embryogenesis length and interrelations of the embryogenesis periods; rescheduling the anlage, formation and maturation of organs (heterochrony), change in the topography of anlages (heterotopia), the development of embryonic membranes, improve embryo protection and trophics; transition to the indirect ontogenesis and vice versa; acceleration of maturing of gametes (neoteny), internal fertilization, and also addition stages to the ontogenesis (anaboly) and care of offspring. Of course, some of these "mechanisms" influenced the ontogenesis as the phenomenon, but mostly, the ontogenesis as the process was reconstructed (i. e., morphogeneses).

Originally the ontogenesis was being formed as directed process, and his ultimate goal — to ensure the reproduction of the offsprings "of its own kind", which could perform the functions in the biosphere previously performed by its ancestors.

Returning to the dual nature of the ontogenesis (as a phenomenon and as the process) and the philosophical interpretation of the categories of "phenomenon" and "entity" we should focus our attention on the well-known definition: penetration into the phenomenon is possible only through studying it. There is a mandatory logical connective between the categories phenomenon and entity — learning process (fig. 1).

As can be seen in the scheme, the process of cognition of the ontogenesis is multiple-vector. Paleontology gives useful information for the ontogenesis analysis (recapitulations) (Shishkin, 2012). The science anticipates a genius, who will be able not only to summarize the knowledge of all the sciences, but also see something in the phenomenon, that is no one have seen before. Is it possible? Let us leave it unanswered. It is to recall the statement of G. Yu. Lubarsky on the situation in science, which is emerging because of the unfocused facts accumulation: accumulation of the facts is excused because one day the theorist would come and sort it in order, make generalization and a theory. "However, even if such a theorist will appear, he will be gasping for the lack of evidences

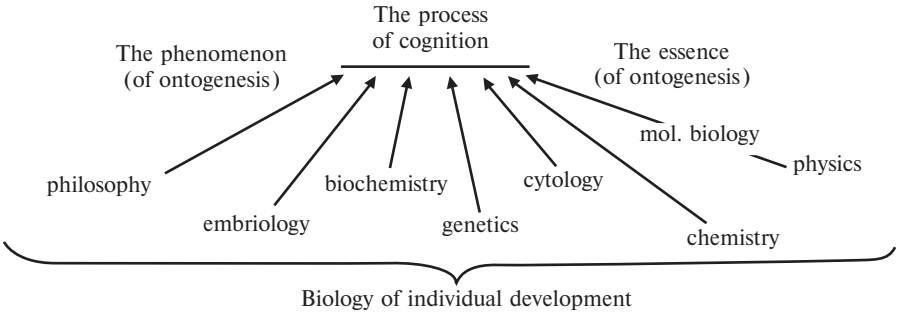

Fig. 1. Process of ontogenesis cognition.

Рис. 1. Схема процесса познания онтогенеза.

"in purely empirical articles" (Lubarsky, 1994). This suggests there is a methodology deficiency in the ontogenesis study. However, each of the sciences has certain developments in the study of this issue.

Geochemical and biochemical aspects of the origin of ontogenesis

It will be logical to assume that the nascent living matter could exist and evolve, in the case if it could reproduce itself. Therefore, the mechanisms of reproduction evolved in parallel with the evolution of life, which is reflected in the famous thesis "a living from the living". The question is: where did the life come?

There are two alternative views on the origin of life on Earth: it was conceived and created by the Creator or it emerged naturally as a result of geochemical, biochemical and organic evolution of matter. The most coherent theory of the life origin is Oparin and Haldane's theory, which has both supporters and opponents. On this subject, there is an extensive literature that indicates unresolved problems.

The monograph by G. P. Korotkova (1979) contains enough proper data review and analysis of the "chemical" origin of life and ontogenesis, assertions on this issue the author argues on the basis of the works by V. Vernadsky, A. Oparin, M. Kamshilova, D. Bernal and others.

Obviously, all judgments about the origin of life and ontogenesis are more or less well-reasoned hypotheses, regardless of confirmation or refutation by the experimental data. So rightly is to suggest other hypotheses that arise in the discussion of the existing ones.

There is no credible evidence for that the heavenly bodies or planetary systems can produce "their own kind". However, the assumption of a plurality of, for example, solar systems could create assumption, of their reproduction. Inexhaustible number of chemical elements in the Earth's history (C, H, Fe...) suggests their reproduction in the period of history, which was before the occurrence of organics. Also the possibility of origin of the new elements from the existing is known, for example, the formation of the helium from the combustion of hydrogen. Hence the reproduction is the immanent (and permanent), property of Nature, and all that occurred in nature, endowed with the ability to reproduce. This "power" has been changed and intensified (evaluated) in the transition from the organic geochemical evolution, elaborated and improved the mechanisms of reproduction.

Consider another aspect. In the geological epoch of Earth's history solar energy falling on the Earth, was "wasted" (chemical reactions seems to occur by the internal energy of the Earth). Cycling of matter and energy flows (geochemical period), apparently were still in its infancy and had a local character. Earth was "interested" in the appearance of consumers and transmitters of this energy. That situation stimulated transition from the geochemical to biochemical and organic evolution. The growing cycle of matter and energy have also was "interested". Synthesized organic matter, and later probionts, bionts, coenoses, primitive organisms, which consumed energy from the Sun, not only converted it into energy of life, but over time started to accumulate that energy.

They stepped up the metabolism, keeping the solar energy at the surface of the Earth and in the waters of the ocean, bringing the significant changes in the circulation of matter and energy, raising it to the level of the biosphere to coenotic, and accelerating evolutionary processes. As V. I. Vernadsky (1930, 1967), and later M. M. Kamshilov (1970) suggested, the components of the cycle, becoming biological, became individuals. Individuals became real bearers of ontogenesis.

A few remarks to the problem. The energy, as well the matter, are carrying the information. (To some extent this assertion does not match the cybernetic interpretation of the information.) Hence: the information is also included in the cycling of matter and energy flows, and in it, as in the cycle, also contains information on how the transformation (evolution) of matter, energy and circulation in case of a particular planet. We can not agree with the authors (e. g. Goodwing, Lennox, 2007), who believe that the information carrier is only the mind. Are bricks which are lying on the road, or a boulder in

the forest, do not have the information? Then on which basis of paleontologists, and forensic evaluators draw their own conclusions?

Mind retrieves the information, analyzes it, converts it, and creates new information on this basis. That is, the mind, from our point of view, is the secondary creator and bearer of information, when the first is the matter and energy.

The interesting idea about the properties of the information was expressed by A. A. Lyapunov (1965). In particular, the information is not subject to the law of conservation. The information, as opposed to matter and energy can be re-created or irretrievably lost (cited by Eskov, 2000). "Lost information", apparently, is the information about the technology of construction of the pyramids, and... of the origin of life. The task of the mind is not only to create a new information, but also to reconstruct the lost knowledge, and the science is based on it.

In this section we intended to show that it is unproductive to deny the possibility of the initiation of the processes leading to the evolution of life on the Earth for the geochemical stage. Indeed, a combination of chemical elements that exist on the Earth originally led to materials with any desired properties. These materials have been created by human (by human mind) who have studied the essential properties of the original materials in the last 100–200 years. So why do the chemical reactions and recombination of the original elements with the third forces (catalysts, autocatalysis, heterocycles, solar energy) could not lead to organic, self-organizing systems, and later to the life, having on it indefinitely time (billions of years), energy and materials? V. N. Snytnikov (2006) substantiates a very bold idea of the "astrocatalysis", which states that "...the primary organic compounds were synthesized in the protoplanetary circumstellar environment, as planets form in areas of the catalytic synthesis of organic compounds".

Role of the cycle of matter and energy in the evolution of ontogenesis

V. I. Vernadsky believed that life was not orignally existing in the form of organisms (individuality), but as a matter of the biosphere.

Among the trends in the evolution of biosphere V. I. Vernadsky listed the accumulation of energy, emergence of new forms of the chemical elements migration, tendency of biogenic migration of atoms to a maximum, increasing role of living matter in formation and stabilization of the Earth surface.

V. I. Vernadsky assigned the crucial role in the current system in the biosphere to the cycling of matter and energy. That means that the cycle, escaping from the entropy, is in constant need of intensifying the biogenic migration of atoms, which, in turn, requires new forms of migration and expansion of the arsenal used in the biosphere resources.

In our view, the "new forms of migration of atoms" can be achieved mainly by the life forms, and only they are able to intensify the biogenic migration of atoms (Kovtun, 2006). Naturally, the dynamic stability of the cycle could be maintained by the stable "work" of its components. Such stability is inherent for the components that can play its unique role in the cycle and in the whole biosphere for more or less long time, perfecting it in a changing environment (under the control of natural selection and the cycle of matter and energy). The "components" (biont, coenobionts, organisms) preserve and maintain the required level of their unique function only by the reproduction of "their own kind" and giving them their functions in the cycle. The mechanism of transmission is the secret under seven seals. However, there are traces that leads from the period of chemical evolution, the chemical cycle of matter and energy (Korotkov, 1979).

Life as the biosphere (Vernadsky, 1967), coenoses (Korotkova, 1991) or ecosystems (Eskov, 2000) had an abstract character with a high degree of the heteromorphic elements, composing coenoses. Heteromorphicity implied the heterofunctionality of certain elements, and this is a "material" for natural selection. The question is, how the "precursor elements" for keeping the system cycles, were able to transfer their (possibly unique)

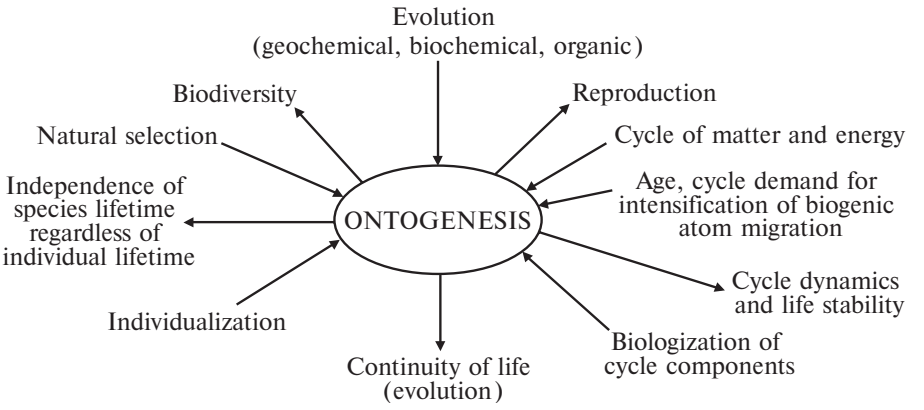

Fig. 2. Factors that initiate ontogenesis germination (↙) and ontogenesis (↗) derivatives.
Рис. 2. Факторы, инициирующие зарождение онтогенеза (↙), и производные онтогенеза (↗).

functions in coenoses to the "child elements"? Or you must admit, that "immortality" of the elements that based on their "chemical" nature should not be taken absolutely unreal. If you recognize the latter, we should admit the fact that ontogenesis, as such, to the coenosis stage of evolution of life, has not been formed yet. (There are statements about "immortality" of akaryote unicellulars; Eskov, 2000.)

In the works of these authors, there is the thesis that the individualization of life comes through the biologization of cycle components. The inevitable consequence of the acquirement of biological function was the loss of "immortality". The very urgent task is a transmission to the biological components the cycles of their (unique) features and functions in coenosis, biosphere to the next generation "components". During this period, a phenomenon called "ontogenesis" appeared. As the ontogenesis arose in the process of "biologization" of "non-biological" components of the cycle, it was bound to use the mechanisms, which existed among the non-biological components of coenoses. Others did not exist.

Let us return to the heteromorphic and heterofunctional coenoses, that offered great opportunities for natural selection. It is natural to think that the natural selection was productively (constructively) worked in the "original chaos", as it had some clear guidance or tasks. These "guidelines" were defined by the needs of the biotic cycle of matter and energy. That means the natural selection had to work "for hire" in the cycle, selecting bionts and then individuals with the necessary at this time functional, biochemical properties, capable of increasing biogenic migration of atoms and the emergence of "new forms of migration of chemical elements" (Kovtun, 2006).

While selecting the functional properties of the individuals, selection was also simultaneously (indirectly) found the transmission mechanisms of these properties to the offspring. Therefore, the individuals has recieved the mechanism of offspring properties transferring, as a set of mechanisms inherent the coenoses elements, components and cycles (i. e., originally having chemical nature). A mechanism of unique properties transmission to offsprings and mechanisms of reproduction were improved through the trial-and-error process.

Obviously it can be argued that ontogenesis as a phenomenon was formed in the biologization of circulation components up to individualization of bionts. Further evolution occurred by improving morphogeneses those implemented the ontogenesis, i. e., the component of the ontogenesis, which we call the process of its implementation.

Thus, we believe that there is reason to consider the cycles of matter and energy (chemical, biochemical, biotic, or a "system of cycles", as V. I. Vernadsky called them) initially "are interested" to form individuality (and consequently, the reproduction mechanisms) as stable and reliable components to ensure the continued functioning of

the cycle and the whole biosphere (escape from entropy). If so, then the cycle of matter and energy flows is one of the leading creators of the ontogenesis (as a "phenomenon" and "process"). Natural selection was the tool of the cycle (fig. 2).

Variability and stability of ontogenesis

Duality of the ontogenesis (as a phenomenon and process) is shown in its other characteristics, in particular, in its variability and stability. M. A. Shishkin considers the stability phenomenon of ontogenesis is an important characteristic: "...any concept, which could be a new stage in the development of Darwinism, should be evaluated primarily by how it is able to explain the origin of the stability of the normal ontogenesis" (Shishkin, 1988).

It seems that the variability of normal ontogenesis in its formation and evolution is not less interesting, these phenomenons were parallel. (Variability as an intrinsic property of the nature existed on the protobiological stage of evolution, so in the process of "biologization" the components of cycle (bionts) "inherited" this variability.)

It only seems that nature of variability has less riddles. The origins of variability, probably lie in heteromorphic cenoses, protobionts, primary bionts; variety of physical and chemical organization of the different parts of the Earth surface and in a well-developed hybridization ability of early bionts (Korotkova, 1979); " heterogeneous living matter always observed in the biosphere, and life is always performed various biogeochemical functions simultaneously" (Vernadsky, 1930).

While analyzing the variability of ontogenesis, we cannot ignore the variability and diversity of its components (the mechanisms giving a start to ontogenesis and accompanying it all over) as follows: the type of reproduction, fertilization, types of zygote cleavage, gastrulation, types of cell cleavage, speed and timing of the prenatal ontogenesis flow, development (direct, indirect, etc.) In addition, each of these components has its own nuances, and is variable in its turn. For example, the length of prenatal ontogenesis in vertebrates is from a few days up to six years or more, the number of offspring in a brood is from one to several tens of thousand, the number of broods per life is from one (for salmonid fish) to ten or more, the number of broods per season is from zero to 3–4; procreation is the viviparity, oviparity, oviviparity etc.

Equally diverse is the asexual reproduction: the binary division in the bacteria, unicelullar algae, fungi, the architomy and paratomy of the worms, the formation of zoospores in multicellular algae, spores in mosses and ferns; internal kidneys of some multicellular invertebrates, etc. Possibility of transition from asexual to sexual reproduction and vice versa is also important, as well as parateny, hermaphroditismy, monosexuality: males are unknown in one of the groups of echinoderms (Desnitsky, 2005). An example demonstrating the duality of variability and stability of the ontogenesis is given by P. G. Svetlov (1972): the developments of the ascidians by the sexual and asexual reproduction are profoundly different, but it is really difficult to distinguish the adult ascidia, which was developed from the zygote by the embryogenesis, and the ascidia, developed by budding, as they are identical.

The components discussed above, were acquired during the evolution of ontogenesis, but their variability refers to the evolution of ontogenesis as a process, i. e., morphogeneses, which realized ontogenesis as a phenomenon.

The original variability on the stage of protobionts and primitive bionts was very probably disordered and chaotic. The gradual evolution of life towards the individualization eliminated "non-constructive" manifestations of variability. The biotic cycle and natural selection were becoming regulation factors. Since the selection can operate effectively in the presence of environmental factors variation and heterogeneity of the coenoses components (biosphere), then it maintains a "constructive" part of the variability and scoops the carriers of function, able to intensify the "biogenic migration of atoms" and expand the arsenal of used resources of the biosphere. In addition, as already was men-

tioned, the natural selection as a tool of the cycle is likely not so much interested in a form of organisms, but in their function in the biocoenosis and the biosphere, thereby, the ability to do their "job" based on the needs of the cycle and the biosphere in a given space and time.

The unique functions in coenoses, biosphere and in cycle can be performed only by fully formed organisms (definitive), but not their embryos.

We suggest that these are the reasons of the morphogenetic variability of ontogenesis as a process (especially in its prenatal period) with the stability of the end function and form of the reproduced product connected with it.

In this case the natural selection performs the search function, based on the needs of the cycle, and the stabilization function for the form and function of the organism.

The evolution of ontogenesis (discussion)

This problem has a lot of questions and only a few answers of a hypothetical kind. is the only axiomatic issues are that the living matter was able to reproduce itself from the beginning, and that the ontogenesis, as such, should be formed with the development of individuality...

If we follow the theory of the origin of life in a natural way, i. e., by evolution, then we recognize the emergence of ontogenesis during this evolution, that is in the process of biological function of matter.

Obviously, the most difficult part of the problem of ontogenesis are the conditions and stimulating emergence of ontogenesis as a phenomenon and initiation of mechanisms for its implementation.

Heredity is only a part of ontogenesis, one of the many. The mechanism of transmission of hereditary properties has been discovered, but the emergence of this mechanism still a mystery. "Complexity" of this issue makes us talking of the Creator or the Mind, the only feasible solution of this problem. We believe that the extreme "complexity" of the issue was dictated by the failure of our mind to create a self-reproducing cell, which is functioning as a factory for production of something. However, the difficulty disappears if we accept the natural process of matter evolution, accept the fact that the Nature was the Creator, which had unlimited time, energy, materials, and other unknown, but necessary conditions. The possibility of nucleation processes that characterize life on the stage of geochemical and biochemical evolution of the Earth was proven in many studies (and a lot of authors refute it) A selections of publications on this subject can be found in the monograph of G. P. Korotkova (1979) about the role of a "system of cycles", constructive ideas contained in the works of V. I. Vernadsky (1930, 1964). The most constructive idea is that individuality was formed by the "biologization" of the cycle components, which (components) were hitherto of a chemical nature. A new task – is arising: to find out what was the "attractivity of the biologization" for which the components of the prebiotic cycle sacrificed their own (albeit relative) "immortality"?

The point is that the "immortality" is static by nature (because of restriction, and possibly complete absence of adaptive abilities of the prebiotic cycle ingredients), it limits the selection process and, therefore, the "job" of natural selection. "Biologization" eliminated static nature of the cycles of matter and energy, enlivened the biosphere, creating conditions for the emergence of the biotic cycle of matter and energy, biological evolution, escaping from entropy. There is another assumption: that biologization cycle components could occur with the possibility of saving (extension) function of the components which were biologized in the cycle. Therefore, the transfer mechanism of this function already existed, and it could not raise up from anywhere but, from the preceding (prebiotic) history of the components. I. e., along with the biologization of components, the cycle and mechanisms of preservation and transfer functions in the cycle and the biosphere were also biologized. Ontogenesis as a phenomenon was conceived in the

bowels of the geochemical evolution and chemical cycles. Chemical reactions were transformed in the morphogenesis.

Ontogenesis as a phenomenon encompasses all forms of life, ensuring existence of hundred of times longer than the existence of their representatives: individuals. This is one of the essential qualities of ontogenesis.

However, the presence of the existing diversity of life forms suggests there were several ways of the evolution of ontogenesis, often calle several onthogenesis types in the literature. Based on the fact that the main function (task) of the ontogenesis as a phenomenon, in all types of life forms in general, is saving of the continuity of the species, regardless the individuality life span. However, other properties and characteristics of the ontogenesis as phenomenon may vary significantly: the duration of the prenatal period, the duration of life of individuals, types of fertilization and reproduction, development of embryonic membranes, direct/indirect types of ontogenesis, care for offspring, or its absence, etc. These differences reflect the different evolutionary paths of ontogenesis, the way gone to stabilize its basic and common properties of all the life forms (reproduction, regardless of life span duration of an individual).

Further evolution of the ontogenesis seems to be done by the reorganization (evolution) of mechanisms of morphogenesis, and restructuring of the ontogenesis process as its general properties are stabilized. Compared to variety of specific ontogeneses (even if you take the taxa of one class, for instance, mammals), the diversity of techniques or mechanisms of morphogenesis is minimal: division, differentiation, growth, migration (cells), concentration, transformation, gastrulation, and perhaps a few others. But almost all of these modes or mechanisms of morphogenesis are also highly variable. Variety of specific or particular ontogenesess is resulted from rearrangements (recombinations) and lability of morphogenesis modes that modify the course of ontogenesis in a particular environment (and adapt the ontogenesis for changing environmental conditions.)

Based on the above, we have suggested that the evolution of ontogenesis as a phenomenon ended with the emergence of life forms and types of high-level taxa (classes, orders...), as well as general (common) features of ontogenesis. The variety of a particular ontogenesis is the result or consequence of adaptive radiation of species and modification of individual development by restructuring and lability of morphogeneses. This issue we consider with the example of ontogeneses of the nestling and precocial birds (Kovtun, Shatkovskaya, 2011): the new norm ("nestling") is created based on the "bird" ontogenesis is not a separate (nestling, half-nestling) type of evolution, but a modification of the basic "bird" type of ontogenesis. The more so that the stabilization of the new norm is not the straightforward fact. There is evidence that a transition from the nestlings to the precocial, and vice versa (Starck, Ricklefs, 1998), but, as is commonly believed (the Dollo's rule), the evolution is irreversible.

Summarizing this all, we consider the essence of ontogenesis (at the level of nowadays knowledge) to be providing the life forms with all levels of the organization, ability and opportunity to produce "their own kind", thereby maintaining the stability of the biosphere and the dynamic cycle of matter and energy flows, i. e., procreation, and ability to accept relay-race from predecessors to maintain their usual role and function in the coenoses, biosphere and system cycles. This property is strictly controlled by the cycles of matter and energy, through the natural selection, by selecting a normal phenotype, it also selects the useful ontogeneses (Shishkin, 1981). Stability of ontogenesis is derived from here.

These essential features and objectives the ontogenesis is implementing through morphogeneses, which accomplish the whole process of development.

The essence of the process (accomplishment of ontogenesis) is, apparently, in the lability of its mechanisms, and the ability to direct the implementation of ontogenesis, depending on the condition and needs of internal and external environment, provide adaptability of ontogenesis stages, implementation of ontogenesis as a whole process.

These definitions lack "internal relations" that characterize the essence of the phenomenon and the process. Their interpretation, for nowadays is one of the main objectives of biology of individual development.

The doctrine of ontogenesis (as creation of the theory of ontogenesis) seems to be in some crisis: the lack of new ideas, vague (and sometimes absence) of so-called "organizing concept". An idea occurs (perhaps quite an unpopular one) that methodological constructivity should bring into the doctrine of ontogenesis certain, shall we say, "moderate reductionism".

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