The Seeds of Life

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Abstract
In this article it isn't discussed concrete chemical mechanisms of origin of life but is given some common considerations, which can promote to the critical comprehension of existing approaches. The second section concerns physical, cybernetic and anticipatory aspects of the life evolution. The different approaches to the problems of biological evolution are discussed in the third section of the article. The attention is focused on the biosphere evolution, which is regarded as the control factor for the biological evolution. In the fourth section the problem of the origin of life is discussed. One of the conclusions is the mechanism of panspermic hypothesis could work only if the conditions on planet has specific features which can be described within a framework of so called the embryosphere hypothesis.
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1 Introduction

Traditional approaches to the problem of the origin of life concern as a rule the different mechanisms of beginnings of known structures of organisms. At the same time, every living biological system isn't simple sum of separated parts; any bio-system (not only organism but ecosystem too) is functional system in which the activities of different components are inter-coordinated. This is the consequence that any bio-system has the developed control systems, which promote such conduct of the components. Therefore in order to understand how the life arises it is very important to investigate cybernetic aspects of life. This direction of studies isn't enough developed in the meanwhile and this theoretical work is one of attempts to find out general regularities of the functioning of any living systems. The stated below reasoning demonstrates the genetic interconnection between their survival and the **anticipatory capability** to predict the "local future" by means of simulation of current situations along the life of bio-system. How such simulation is accomplished is very interesting problem; obviously that is not possible if the system has no mechanisms of memory.

In this context the concrete chemical mechanisms of origin of life isn't discussed in this article but it is presented some common considerations, which can promote to the critical comprehension of existing approaches. The second section concerns physical, cybernetic and anticipatory aspects of the life evolution. In the case of any living systems, their levels of entropy "strives" to be less than the entropy level of

surroundings. This situation is the result of that any living system is able to modify the peculiarities of interaction with surroundings in order to avoid destructive influences and to use external energy flows to support necessary for vital functions the reduced level of entropy of own structures. Thus, just the management by the interaction with surroundings by means of specific regulations enables these systems to be surviving. In order to emphasize that regulations support the preserving of biological system the notion of the Life Demon was introduced (see Levchenko, Khartsiev, 2000 and section 2). Any Life Demon is in fact some main a meta-prescription (a supervisor), to which other regulations are subordinated. One of the main features of any Life Demon is that it ensures the self-preserving. The Life Demons are being transmitted along generations by genetically i.e. by means of so called "vertical" information transfer. After appearance of possibility of informational exchange by linguistic way, the effective "horizontal" information transfer was finally established. Such process can be similar to the process of virus propagation. The different approaches to the problems of biological evolution are discussed in the third section of this article. The attention is focused on the biosphere evolution, which is regarded as the control factor for the biological evolution. In the fourth section the problem of the origin of life is discussed. One of the conclusions is the mechanism of panspermic hypothesis could work only if the conditions on planet has specific features which can be described within a framework of so called the embryospere hypothesis. Some of above problems were considered in our previous articles in IJCAS (1997, 1999, 2000), the development of these approaches is given in this work.

2 Physics of the Life as Cybernetics

The names of sciences "physiology" and "physics" are originated from the same Latin word *physis* (nature) what isn't accidental because both of them are engaged with common laws of functioning for different systems: living and non living. Although any living systems are physical machines in some sense but they have some specific features which provide with their self-preserving. The physiology studies concrete mechanisms of their functioning but has still no general paradigm which allows to reply to the question: is some concrete natural process vital function or not?

If to compare the peculiarities of living systems and not living ones, we can see that living systems don't conform to the rules of classical thermodynamics but usual physical objects do that. This means that the interactions between not living objects and surroundings lead to the state when entropy of the every object is near the surroundings entropy. In the case of any living systems their level of entropy "strives" to be less than the entropy level of surroundings. This situation is the consequence that the living systems have peculiar behaviour, in other words the interactions between living systems and their surroundings have specific "non classical" character. These features are maintained by the following: any living system is able to modify the peculiarities of interaction with surroundings in order to avoid destructive influences and to use external energy flows to support necessary for vital functions the reduced level of entropy of own structures. Thus, although any living systems are physical ones but they use

complicated and not fully unambiguous, predictable (by outside observer) rules of behaviour. This gives possibility for living systems to avoid many external harmful influences and helps to derive benefit from resources of surroundings. One can say in summary that the living systems are physical machines which use different algorithms of functioning in order to ensure self-preserving and just the anticipatory management by the interaction with surroundings gives possibility for the living systems be not subdued classical thermodynamics and to be surviving (Rosen, 1985, 1991).

The above consideration enables to unify the approaches to both living systems and not living ones within framework of cybernetics approach. I shall try to demonstrate briefly this below. Any organism has body, which the organism aspires to preserve during all its life. This is important in order to support all necessary physiological and biochemical processes. The body is in unequilibrium status with decreased entropy level in comparison with surroundings and therefore the organism needs all the time the external sources of energy and/or matter (Schroedinger, 1955). Among not living systems some of them can also "strive" to support unequilibrium status of some own parts. They also use external sources for that. For example, this is the thermostat system or the system, which can stabilize the level of liquid. In order to realize the ability to keep some physical characteristic the system has to have both a sensor of this characteristic (it is named receptor in biological language) and some equipment (or effector), which gives an opportunity to change the interaction between the system and its surroundings. This means that the system participates in the feedback "system - surroundings" in this case. More exactly, this system "knows" what is necessary to do after receiving some signals of receptors and, hence, "apprehends" future situation in surroundings (Dubois, 1998a, 1998b; Rosen, 1985, 1991). In technical language this means that the system has possibility to work according to some rules (algorithms, regulations) of behaviour, which contribute to functionate correctly in context of maintenance of above characteristics.

In the case of living systems (and of complicated technical systems as well) these rules are not obligatory immutable algorithms of behaviour. These algorithms are non hard i.e. they are "illegible", "diffuse" ones and they don't determine every step and hard progression for them. The diffuse algorithms set only the final results ("aims") for some groups of the closing steps but permit for intermediate steps to be relatively free. In other words, the concrete strategies are being constructed along execution of such algorithms depending on current situation in each moment of time. This approach is successfully being developing in the theory of games (Welbull, 1995). These peculiarities of the above algorithms - or of **regulations** in more "natural" language - give some relative freedom to many biological processes including evolutionary ones.

In order to simplify the description of operation of the diffuse algorithms in the case of living systems the notion of the **Life Demon** was introduced (Levchenko, Khartsiev, 2000) by analogy with Maxwell Demon. At that the ideas of computer simulation (Levchenko, Menshutkin, 1988) were also used. Any Life Demon is in fact a central meta-prescription (meta-instruction, supervisor) to which other regulations are subordinated. Probably sometimes artists feel this substance of own life: for example, St.Petersburg's Swedish-Russian poetess of the beginning of XX century Edit Sodergran

wrote: "I am immeasurable desire... but of what I don't know. When my desire will end I die" (Sodergran, 1991).

The biological systems of different levels of biological organization have different own Life Demons; one can also say sometimes about the Demon for some sub-systems of a biological system (by analogy with the notion of ecological niche). One of the main features of any Life Demon is that it is such one of regulations, which works to maintain function(s) among vitally important ones. Therefore any Life Demon provides the self-preserving of bio-system. The Life Demons (or, more exactly, meta-regulations of the Life Demons) are being transmitted along generations by genetic way, i.e. by means of so called "vertical" information transfer (about vertical and horizontal transfer see, for example, Grant, 1985 or Timofeev-Resovsky at al, 1977). After appearance of possibility of informational exchange by means of imitation (superior animals, see for example, McFarland, 1985) and especially by linguistic way (*Homo sapiens*), the "horizontal" information transfer was established and the Life Demons which are important for survival of populations and of their members begins actively to use this way for propagation and reproduction. Every such process is connected with propagation of at least one informational message with regulations and this process is similar in some aspects to the virus propagation (Levchenko, Khartsiev, 2000). It is important that just function of self-preserving distinguishes Life Demons from any other regulations as well as from **memes** (Dawkins, 1976) which can have very various informational substance.

Not only the transmission of the Life Demon and other regulations but also of any biologically significant information (Korogodin, 1991) can be described within a framework of idea about transmission of so called **informational messages** (Levchenko, 1994), i.e. the such messages which change evolutionary trajectory of system. In order to estimate the efficacy of some informational message the population approach was proposed: informational message has some positive biological value if its acceptance leads to increase of the population number (Levchenko, 1994). This approach can be applied also to the informational transfer by means of linguistic way. If informational message has enough positive value (more exactly - the **a priori value** for the receiving individuals) then the propagation of this message can be similar to infection explosion - see simple estimations for this case in (Levchenko, 1999). In contrast to the memes, which are being discussed mostly in context of some cultural medium (Brody, 2001) the informational messages are defined on the multitude of biological, physical and some technical systems, the statuses of which this messages can modify. Nevertheless, this approach is appropriate for the consideration of some memes classes.

Although the regulations are not some material structures but the living system needs in their existence. Common sense suggests an idea that if such regulations are simple then they can be kept in construction of the system. In contrast, if the regulations are complicated then the special mechanisms of memory for them are necessary what we can see in many technical applications and in biological world too. For example, the seeds and spores contain collections of the growth regulations (with some

"constructional equipment" for their work), which can be executed if the environment is suitable for that.

Thus, the systems with memory can have peculiar not classical restrictions for their development trajectories (Rosen, 1988). The living organisms use specific regulations - the Life Demons - for self-preserving of their morphological structures and functions of physiological systems. In order to store and transmit along generations the components of these regulations, all known organisms needs the genetic memory; in the case of superior animals the memory, which is ensured by the nervous system is also used. In the more broad case of any biological systems in which can be included the ecosystems and the biosphere the functions of memory, storage are being accomplished by all construction of the bio-system and (or) its separate elements (parts). The appearance of simple regulations, which contribute to self-preserving of some separate **functional module** (Orbeli, 1979, Ugolev, 1990) in system, can be interpreted as origin of Life Demon of the module or as its **self-organization** (Eigen, 1971; Nicolis, Prigogine, 1977).

Turning back to the question in the beginning of the section about how to distinguish is some concrete natural process vital function or not, one can reply: only vital processes are proceeding by under supervising of regulations – the Life Demons – which contribute to the self-preserving of living system. It is not possible to reply to this question in general case if do not take into consideration the role of these processes in the system where they operate.

The general philosophy of above argumentation brings also to the following idea: the properties of any objects which are existing during some period of physical time can be described in the cybernetic language as some sets of behaviour rules. One can also add the properties of such objects depend on immanent regulations of their behaviour (described as physical properties, for example) in environment. If the regulations are changed then the object ceases be itself. All aforesaid about instructing isn't some specific quality of living nature, however just in the case of living systems we have self-instructing of behaviour and development for the self-preserving, in other words the self-instructing of all life flow. It is important this is not possible without mechanisms of both memory and selection. The selection mechanism requests simultaneous presence of some multitude of versions for choice, whence the mechanisms of reproduction and mutations can be deduced. The more "hard" assertion will be the following: the processes of selection lead to the status of the nature when only the such objects are extracted from the multitude of virtual worlds and can be observed along physical time which themselves or their parts have specific regulations of self-preserving. Then the initial "cybernetic" **seeds of life** are contained even in such simple traditionally not living "eternal" objects as elementary particles.

The above consideration will help to discuss the problems of both the biosphere evolution and origin of the life in the planet.

3 Some Considerations to the Problem of Evolution of the Biosphere Life

The discussion about evolution within a framework of traditional biology is going usually in the context of both morphology and functional complication or complexification. Such approach is almost obvious but it doesn't allow to measure the "quantity of evolution" and, thus, to calculate and predict the possible ways of further evolution. The successes of physics in XX century stimulated the elaboration of the evolutionary conceptions, which are based on physical principles and use physical characteristics of biological systems. They can be formulated in the form of some variation principles, for example, "increment of efficacy of energy using for organisms along the evolution" (Shnol, 1979). Of course, this principle can work in some separate branches of evolutionary tree but it doesn't explain the growth, development of this tree. Therefore before discussion about the problem of the origin of life I would like to present also some other not so popular evolutionary approaches.

3.1 Physical Evolution of the Biosphere

In previous works (Levchenko, 1992, 1993a, 1997, 1999; Starobogatov, Levchenko, 1993) the model of physical evolution of the biosphere, which is regarded as unified organism (Lovelock, 1991; Vernadsky, 1989), was elaborated. On the basis of Schroedinger (1955) ideas, it is postulated in the model that each biological system (for example, organism, ecosystem, biosphere) "strives" to function not to decrease an energy flow through itself. Just such bio-systems are being self-preserved under being altered environmental conditions. At that any temporary interruption of external energy flow stimulates the bio-system to physical evolution. At the earliest stages (Proterozoic) the physical evolution was interconnected with an intensification of chemical aspects of photosynthesis, with evolution of chlorophylls. At the later stages (the last 560 million years i.e. Phanerozoic), the physical evolution was connected with the augmentation of photosynthetic surface (leaves and other photosynthetic formations). Apparently, the growing of energy flowing through the biosphere – it was about ten times per 200 million years for Phanerozoic - leads to increase of complexity of biospheric organization (Levchenko, 1993a, 1997). The simplest formulas for physical evolution of the biosphere are presented in the works of Levchenko (1993a, 1997, 1999). The paleontology data confirm the such approach and permit to suggest that the oscillations of the Earth's orbit parameters as well as the periodical decreases of the carbonic acid flow from the entrails of Earth with the period about 200 million years are important external causes of the interruptions in the biosphere scale during Phanerozoic at least. Thus, one can presume there is some predetermination for the physical evolution of biosphere (Levchenko, Starobogatov,1986; Levchenko, 1992, 1993a, 1997).

3.2 The Increasing of Algorithmic Power of the Biosphere Along the Evolution

The physical evolution of the biosphere in reply to different interruptions is connected with complication of organization of the biosphere and with development of its adaptation mechanisms (Gore, 1993; Gorshkov, 1994), i.e. with growing of **algorithmic complexity** of the biosphere system. The development of behavioural regulations of the biosphere enables to adapt for more and more broad diapason of conditions. This growing of quantity and quality of the algorithms along evolution means that **algorithmic power** of the biosphere increases along evolutionary time. This leads to the appearance of new canalization factors for the posterior ways of evolution (this is one of consequences of existence of the bio-system memory). The value of algorithmic power is measured in the energy units and it gives maximal energy flow, which can be managed by the bio-system (Levchenko, 1999; Levchenko, Khartsiev, 2000).

3.3 Auto-canalization of the Biosphere Evolution

One of traditional approaches to the problem of biological evolution is the assumption of some predetermination: both the laws of not vital nature and the pressure of morpho-genetics restrictions (the memory about previous evolution) canalize or determine the ways of the posterior evolution (Lima de Faria, 1988). But the biosphere can change characteristics of local areas in the planet and therefore it can also influence its own surroundings and change some factors of canalization. This means that the biosphere can auto-canalize own evolution (see **paradigm of auto-canalization** in the article Levchenko, 1997). Certainly, such biosphere influences on the way of own evolution by means of feedback through the environment are slow (as, for example, the consequence of appearance of oxygen atmosphere) but they are eventually very important.

3.4 The Evolution as Cognition and Expansion of Interactions of Living Organisms with Their Surroundings

A perception of information from external world by bio-system is important in the context of survival of the bio-system: the information helps to use useful properties of environment and to avoid harmful influences. In order to specify what is the biologically important information, it was proposed to introduce the notion of informational message which is defined as the such part of informational flow which may change development (evolution) of the bio-system because this message changes the bio-system features (see section 2 and Levchenko, 1994). Then, we come to the problem of selecting, separating of informational messages from the common external informational flow. That can be described in terms of "biological context": organisms have to be "tuned" to the acceptance of the informational messages, which help to understand external world and survive in it. The biosphere determines some diapason of possible environment for living organisms and, thus, the diapason of diversity for objects, which can be perceived in the process of cognition of the world by actually living organisms. On the other hand, the life on the Earth is changing the biosphere

system during all the time when the life exists. Hence, the following feedback exists: the living organisms are studying the biosphere and are being changed as a result of that; simultaneously they are building this biosphere (in particular, new biological forms appear). Thus, the cognition canalizes cognition process (see Levchenko, 1999 about auto-canalization of cognition) and we come to the fundamental evolutionary problem: has this process either finale one or not? The hypothesis is the following: if the biosphere system is restricted in size and if the planetary conditions are relatively stable then the process gradually dies out and the system aspires to the status of some "living machine" which is well tuned for this condition (Levchenko, 1993a). If the life is able to go abroad the planet then the evolutionary process is unlimited along the time. Note also that these limitations for the biosphere means that living organisms are not able to interact with any objects, which are placed farther (deeper) some physical boundaries. Therefore, **expansion of the interactions** diapason of living organisms with their surroundings is the reason of the biosphere evolution and of the origin of new biological forms (Levchenko, 1999).

3.5 The Evolution After the Origin of Man

On the last stages of the biospheric evolution when *Homo sapiens* arises the informational exchange between different organisms begins to play risen role for the biosphere evolution (Levchenko, 1994, 1999). This new stage of evolution of the biosphere is characterized by extremely fast expansion of one species - *Homo sapiens* - in all places of Earth, which are accessible for life. Every new step of the development is caused by appearance of new ways of exploitation of the nature. In fact, we are the eyewitnesses of such biosphere evolution, which is ultra-speed, ultra-rate. This is possible because the man has such intellect which allows to him to be super universal among all other species: new knowledge and new experience broaden ecological fundamental (potential) niches of human population (Levchenko, 1999); the realized niches expand into new spheres thereupon too (Odum, 1975). The consideration of processes of both producing of new information by men as well as propagation of the information gives possibility to deduce some simple equations. These formulas demonstrate extremely high evolutionary role of so called a priori value of information (see section 2 and Levchenko, 1999) and therefore of such thought processes, which are used for the creation of a priori models of reality. This dependence of ecological characteristics of *Homo sapiens* species from the modeling of future is the distinctive trait of ultra-rate evolution (Levchenko, 1999).

3.6 The Life Demon is Immanent Component of all Living Systems

The Life Demon is described in the section 2 of this article therefore I will not repeat the same here.

3.7 Pan-Biospheric Paradigm

All organisms of the biosphere are dependent on each other; the life of separate organisms, which are isolated from the biosphere, is impossible. This assertion was named as **pan-biospheric paradigm** (Starobogatov, Levchenko, 1993). The problems of both biological evolution and the origin of the life have to be considered within a framework of this paradigm. Only the biosphere as a whole is relatively independent living system from other ones. The **ecocentric conception of evolution,** in which relationships between evolutionary processes in different levels of biological organization (including macroevolution and microevolution) is described, is deduced from above paradigm.

3.8 The Embryoshere Hypothesis

It can be proved that several evolutionary principles can be applied to organisms, to ecosystems and to biosphere. There are in particular: **a**) the principle of evolution of functions; it can be formulated as the intensification of processes providing some function of the separate functional systems within bio-system along evolution, **b**) the principle of increasing of multi-functionality of separate sub-systems for organisms or ecosystems along evolution, **c**) the principle of over-basis: new functions do not replace previous ones but superimpose over old ones and subordinate them (Orbeli, 1979). These principles can be applied also to the development of embryos (Levchenko, 1990, 1993b). Comparing all these traits of evolution and development, we can suppose that the initial biosphere was the self-preserving system, which can be regarded as some whole primitive organism. It was weakly differentiated system, which developed as embryo by means of differentiation; that leads to the complication of structure and of functioning in this case. The primary biological organisms, which are known as microfossils, were not perhaps independent separate organisms but were something alike organelles of cell. This hypothesis is called the **hypothesis of embryosphere** or, in other words, the hypothesis of the developing pre-biosphere (Levchenko, 1993a, 1993b, 1997).

4 Origin of the Life: as This Could to be? Some Common Considerations

The above general consideration can be translated to the problem of the origin of the different form of life on the Earth and other places of the Universe as well (Shklovsky, 1976). I would convert it to the following main assertions:

1. The origin of the life in the planet was probably connected first in all with the origin of embryosphere. This assertion doesn't correspond with so called **panspermic hypothesis** of Arrenius (Ponnamperuma, 1972) because we suppose that the life doesn't exist without biosphere (Levchenko, Starobogatov, 1993; Levchenko, 1997). It isn't difficult to agree with this approach if to take into account that any living organism requests specific and concrete conditions of surroundings in order to be able to

development and reproduction of the similar to itself. It is unlikely that lifeless nature can create enough often such conditions, which are appropriate for some life. The seeds die if they fall on bad soil, it is notified even in both the Bible and the Koran. The panspermic hypothesis supposes latently that early Earth was "good soil" or, in other words, the planet was quasi ovule, egg for the "cosmic sperm". The embryosphere hypothesis tries to explain how this ovule could be created by some natural way.

2. The first step of origin of embryosphere was connected with the origin of **self-sustained** streams of matter through pristine "bouillon" (liquid environment is very likely for that) on the basis of using of planetary resources of matter and energy, chemical at least. That could be happened by means of **auto-catalytic reactions** (Eigen, 1971). Just auto-catalytic reaction regulates own intensity and, thus, has primary elementary logic. In other words, such reaction has some algorithm, program of passing. The self-organization (Eigen, 1971; Nicolis, Prigogine, 1977) of powerful global **pan-planetary** auto-catalytic processes, which can control planetary conditions and can support them in some diapason, implies both the appearance of long-continued self-sustained processes with concrete logic of passing and the selection of processes. This is equivalently to the origin of the Life Demon of the embryosphere and as result the origin of the embryosphere

3. In order to provide the self-preserving of embryosphere along time the mechanism of physical evolution could be used. That could be realized as successive origin of new auto-catalytic processes under physical and chemical conditions which are produced by already existed processes. The mechanism of that could be the following: when any of existing processes happens to be weakened because the conditions are changed (this means that the interruption occurs) then new similar process which is able to proceed in new conditions arises if the necessary resources exist. The competition for resources between different processes is decreased during the time of interruption and, therefore, both appearance and expansion of new process in surroundings can be more probably. As result of that the quantity and diversity of different auto-catalytic processes is being increased along time and the use of resources of the environment grows.

4. New auto-catalytic processes create new structures, the differentiation of the embryosphere grows. Its different parts exchange between each other by matter. The diversity of the processes gives possibility to support the level of consumption of resources under changing conditions. The growing of energetic flow through the embryosphere along its physical evolution leads to the appearance of new levels of hierarchy organization of embryosphere (Levchenko, 1997, 1999). All this is the auto-canalized process of the **chemical evolution** (Kenyon, Steinman, 1969; Rutten, 1971; Fox, Dose, 1977) of the embryosphere; this process leads to the gradual forming of environment, which is suitable for the origin of pristine biosphere. At the same time, the regulations of adaptive reactions of the embryosphere (they ensure self-preserving of the system) are being complicated because both quantity of components and their complexity are increasing. This means that the Life Demon of embryosphere masters new modes for functioning.

5. In some aspects the embryosphere resembles primitive cell without own reproductive organs. The embryosphere forms the environment, which can be suitable

either for "fertilization" by cosmic sperm according to the panspermic hypothesis (but then we have to say about not panspermic but about **pan-fertilization hypothesis**) or for the origin and development of own version of life. In the second case, the origin of primary organisms can be result of **a**) mixing, complexification of chemical components and complexes (the lipid membranes, for example) of different parts of embryosphere and **b**) self-organization of self-sustained reactions which are preserving these structures. These processes can also be described as **c**) successive structural and functional differentiation of embryosphere and **d**) appearance of simple regulations of functioning for some separate functional modules of embryosphere; this regulations contribute to the self-preserving of above modules and their appearance can be interpreted as the origin of the Life Demons for them. **e**) The origin and using of mechanisms of molecular memory (on the basis of RNA and DNA) during the previous phase could be simple consequence of natural selection of some functional modules within the multitude of different self-sustained structures (Eigen, 1971; Kenyon, Steinman, 1969; there are also different extravagant hypotheses about abiotic origin of DNA for example in comets but they aren't the field of this article).

6. The many self-sustained processes within modern cells (the energy processes, the photosynthesis, for example) could arise in some fragments of the embryosphere until the origin of separate organisms. Some processes in modern organisms may repeat in general traits ancient processes, which maybe were passing within empryosphere. Hence the principal moments in the history of origin of the biosphere resembles the history of origin of separate cell in another scale of time.

The humans now (and another hypothetical intelligent life before now or in the future) which are able to support the life outside the own planet can also contribute to the life propagation in the Universe i.e. they can perform the role of "panspermic carrier" for reproductive substance (Shklovsky, 1976). This can be not only incidental infection by life germs but can be also some purposeful action. In any case this is something alike Adam who is talented by possibility to fertilize the "egg" of embryosphere, and, hence to give impulse for development of life which has traits of both parents.

5 Several Conclusions

The objects of classical physics conform to the rules of thermodynamics. This means that the interactions between these objects and surroundings are such that the entropy of every object strives to be near to the surroundings entropy. But in the case of any living systems the levels of entropy strives to be less than the entropy level of surroundings. This situation is the result of that the living systems have peculiar behaviour: the interactions between living systems and their surroundings have specific not classical character and features. These features are maintained by the following: any living system is able to modify the peculiarities of interaction with surroundings in order to avoid destructive influences and to use external energy flows to support necessary for vital functions the reduced level of entropy of own structures. Thus, just the management by the interaction with surroundings allows to the living systems to be surviving. It is necessary for such management to apprehend the surroundings situation

and to have the possibility to act according to some rules of behaviour, which have to be appropriate to concrete situation. In the case of living systems (and complicated technical systems as well) these rules are not immutable algorithms of behaviour. These algorithms are not hard and they don't determine hard progression for every step. These "diffuse" algorithms (or in another language regulations) set only the final results (aims) for some group of the closing steps but permits for biological system to choose intermediate steps. These peculiarities of the regulations give relative freedom to many biological processes including evolutionary ones.

In order to simplify the description of functioning of the regulations the notion of the Life Demon was introduced (Levchenko, Khartsiev, 2000). One of the main features of any Life Demon is that it is diffuse algorithm which works to maintain some function(s) among vitally important ones, therefore any Life Demon provides the self-preserving of biological system. The Life Demons are being transmitted along generations by genetically i.e. by means of so called "vertical" information transfer. After appearance of possibility of informational exchange by linguistic way, the "horizontal" informational transfer has been established. This process in some aspects is similar to the process of virus propagation. Thus, one of particular definitions of the life can be the following: the system is living one if it has own Life Demon. The biosphere evolution demonstrates the origin of different Life Demons for different levels of biological organization (for embryoshpere, for ecosystems, for organisms) and also the development of the Life Demons. This approach enables to translate both the problems of biological evolution and the origin of the life in the language of description of specific regulations: Life Demons.

The above considerations enable to formulate the "engineering" definition of life: the life is the self-sustained process which reestablishes all the time organization and low entropy level of some structure by means of using of external sources of energy and matter and also of specific regulations of behaviour. The physical evolution concept (see 3.1), which can be used for embryosphere and biosphere, is deduced from such definition. In order to save the regulations for functioning of bio-system, the memory systems are required. The origin of separate organisms is connected with the origin of molecular memory mechanisms. We have still no enough data to solve are the reasons of that the terrestrial or cosmic (panspermic, for example) factors. On the other hand only the biosphere as a whole is independent living system (see 3.7) while all organisms of the biosphere are dependent on from each other and, therefore, it is impossible the origin of separate organisms which are isolated from the biosphere. Thus, the question "what is the origin of life: either origin of organisms or origin of biosphere?" - isn't correct. In any case the appearance of successfully surviving separate organisms with molecular memory was the natural step of conversion from embryosphere to pristine biosphere.

One can point to two main regularities for the observed "flow of life" on Earth which are connected with the problem of predetermination of evolution. The first regularity demonstrates some predetermination of physical evolution of the biosphere. This enables to describe the development of planetary conditions from primitive chemical processes up to pan-planetary ones, or from embryosphere up to the modern biosphere.

The second regularity demonstrates not predetermination of the phenotypical realizations of biological evolution. That is connected with the following: the many changes of biological forms along biological evolution are ecologically neutral ones (Levchenko, Menshutkin 1988; Starobogatov, Levchenko, 1993).

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