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Thoughts on Progress in Biological System Developments

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Abstract: *Examining the opinions on the problem of progress in biological evolution shows a critical situation, going so far as to deny the existence of any progressive tendency.The general cause of this situation lies in how to approach the problem, in individualistic, reductionist thinking.Some authors agree the existence of an evolutionary tendency towards "better" without specifying who this "better" refers to and what it consists of. In most cases "good" or "evil" are referring to the individuallevel.It is considered that a major shortcoming in accepting the idea of progress is the lack of evaluation criteria and of some ways of measuring this evolutionary tendency, when it is admitted. A series of scientists are proposing certain criteria in assessing an evolutionary tendency, such as increasing the structural complexity or comparing the evolution of animals with the human species, taken as a standard.It is obvious that all these outlooks are the consequences of the unilateral, reductionist approach to the problem.There are some attempts to overcome this dogmatism, but they are ignored, being silenced.Getting out of the deadlock requires changing the way of approaching the problem. Only accepting the systemic conception regarding the organization, functioning and biological evolution should be explained increasing the energy captured, either by way of structural growth or simplification (usually both processes are combined) that ensure evolution and prosperity ofspecies.The human species cannot be considered as a standard because its evolution is no longer a biological process. His activities are leading to a decrease of biodiversity and the tendency of the biosphere to approach the state of thermodynamic equilibrium.*
Key words*: biological evolution, philosophical outlooks, capture of energy, man and biosphere.*

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I. Introduction

The renowned naturalist, mathematician, astronomer and encyclopaedist Georges-Louis Leclerc, Comte de Buffon (1707 - 1788) was the father of natural history and of the first principle of biogeography. Buffon observed that "*in spite of analogous environmental conditions, different plants and animals are living in different geographical regions*". According to Buffon transformist, species can spread out from their original centers of evolution, undergoing "improvements" and "degenerations" and for this reason he was considered Darwin's forerunner.

Jean - Baptiste Pierre Antoine de Monet, Chevalier de Lamarck (1744-1829), became famous in 1809 (when Darwin was born), with his work *PhilosophieZoologique* stating that organisms are adapting to environmental conditionsand their intrinsic nature causes them to become complex, "improved" forms from simple forms. In other words, the desire of organisms to adapt to certain environmental conditions should be the mechanism of transformations. More, the acquired features are preserved from one generation to another, by heredity.

Charles Darwin (1809 - 1882) understood and noted the phenomenon of diversification of living things through the evolutionary changes of the descendants. Darwin (1859) gave the scientific explanation of the transformation and diversification of the species and the higher taxa.Under the action of natural selection - a necessary consequence of the struggle for existence -, these taxa are subject to gradual transformations, from simple to most evolved forms, and the ancestors of the current living forms were unicellular organisms.

Under natural selection's pressure - as a consequence of life-long struggle -, they are subdued to some gradually transformations from simple to most evolved; the ancestors of today's beings were unicellular organisms.So that, in19th century –were long debates, if beings evolution is directed and if yes, is it progressive?

The anthropocentrists Blitz (1992) and Ruse (2009) considered that the human species is the climax or highest point in development of this progressive evolution.Smith (1988) emphasized that evolutionary theory, by natural selection, implies a direction of change, but does not foresee growth or progress. Some directional changes may be expected, but these can only be viewed as opportunities for future adaptive improvements.

II. Discussions

Stewart (1997) commented on what conditions evolution is progressive. First of all, one has to identify an inexhaustible potential beneficiary of the adaptations, potential that must continue to favor the future adaptations. Secondly, this potential for adaptation must apply to all vital processes, over time and not be generated by the different possibilities, which vary according to the local situations of space and time.

Evolutionary processes (e.g., natural selection) cannot exhaust the potential benefit of cooperation by simply establishing and optimizing collaborative relationships between living beings. Natural selection is able to exploit for the most part the benefits of cooperation between living entities, only through the formation of a complex organization of those entities, which are on a small scale in space and time. Thus, the organized cooperation of the molecular processes led to the formation of the first cells. Then, the organization of the cells led to the emergence of metazoans and, according to the cited author, the organizations of the people formed the societies.

However, the benefits of cooperation between these complex organizations, except for the formation of higher levels of organization, cannot be exploited by natural selection. The indefinite repetition of this process will widen the scale of the space and time of the organizations, in which the benefits of cooperation are exploited, but the potential of cooperation between organizations on the largest scale will remain. This is the case of metazoans that can adapt more successfully to large-scale threats than single-celled organisms can adapt. Most of the time, natural selection will favor individuals who use resources rather for their own benefit than for the benefit of other individuals. Those who use the resources in cooperative activities that will be predominantly for the benefit of others will likely oppose the selection, regardless of how beneficial the effects of cooperation will be on others and whether the result of cooperation is more competitive as a whole.

However, the topic of progress in biological evolution has long been debated, and Nitecki(1988) summarized in the book "*Evolutionary Progress*", with opinions on the notion of progress and the criteria proposed for evaluating this progress, followed by a critical analysis of the current situation on the progress in biological evolution.

Botnariuc(2006) addressed the issue of progress in biological evolution from the perspective of the hierarchical organization of biological systems. The basic idea of his approach starts from the third law of thermodynamics. According to this law, the biological systems at all levels of organization (from individual organisms to the biosphere), tend to move away from the first state (of thermodynamic equilibrium), which requires a permanent energy capture in the respective systems. The increase of the energy supply and the efficiency of its use becomes the basic factor for the evolution of biological systems at all levels of organization.

First, the notion of progressive evolution was used to express the general idea of evolution of the living world, from single-celled organisms to the most devolved plants and animals. Although today all the phases/stages of the evolution of life coexist, it was shown that the living beings appeared gradually, from the simplest (in the case of bacteria) to the most evolved forms of life.

Other notions also gradually emerged, with the intention of replacing or clarifying their meaning, ending with a complete rejection of the idea of progress in biological evolution.

The notion of progress has an axiological character - a coherent chain of statements, from which other statements are deduced. The notion of biological progress requires criteria that allow the evaluation and measurement of evolutionary changes.

Ayala (1988) defined progress as a “systematic change of a characteristic for all members of a sequence, so that subsequent members of that sequence would show an improvement of that characteristic. Simply, progress can be defined as a "better" shift. He also proposed several criteria to evaluate which means "better" from the above definition:

- increasing the level of genetic information; - increasing the number of individuals and species;
- increasing global biomass;
- increasing the flow of energy.

Dobzhansky (1989) established that there is no generally accepted meaning in defining the progress in biological evolution and suggested four criteria:

- increasing the structural complexity of organisms and structuring genetic information;
- independence and ability to dominate the environment;
- development of the nervous system and sense organs;
- the development of self-awareness and abstract thinking(applicable only to animals).

The main difficulty in applying these proposed criteria is the lack of methods to measure them. Therefore, Ayala (1988) considered that "*It would be appropriate to ask whether something would be gained by talking about evolutionary progress, rather than evolutionary advance or directional change*." Then Ayala himself found the lack of axiological value - those coherent chainofstatements.

Severtsov (1936) made an essential contribution to understanding progress in biological evolution. According to him, there are two biological processes, different in their content:

1 - biological progress;

2 –morpho-physiological progress.

The **biological progress** consists in the development of adaptations that lead to the prosperity of the species. For biological progress, the species are characterized by three characteristics:

- increasing the number of individuals;
- extension of the areal;
- the differentiation of new forms within the old ones and from this results the divergence of taxa.

The three characteristic features of biological progress can be achieved through four **morpho-physiological** pathways:

a -**aromorphosis** or structural-functional changes that increase the energy level for the activity of the body. In the process of evolution there are nodal moments that lead to the emergence of new taxa, of higher category. In Vertebrate there are a few examples of aromorphosis:

- the appearance of the subcutaneous Gnathostomata by transforming the branchial arch into the mandibular arch, thus allowing an active feeding, which is also suporting the transformation of scales into teeth; this is an example of how passive feeding **has progressed** into active feeding;
- the appearance of fish in the ventral bladder, which then became the lung of the tetrapods;
- the appearance of the limbs with fingers;
- transformation of the heart to separate the arterial circulation from the venous etc.

Zavadsky (1966) gave some examples of aromorphosisfrom the plants world:

- the emergence of new organs in the higher plants, as in the case of the conducting tubes;
- the appearance of leaves, flowers, seeds, etc.

All these examples show that aromorphoses are very general, even universal adaptations.

b **- idio-adaptations** (consequence of adaptations) represent a second path of biological progress. They are small changes, adaptations to local conditions, particular, as it is the case of protective colors and forms, of the specialized dentition to different modes of feeding (diets), as well as extreme specializations, as is the case with adaptations to life in caves, in the depths of the seas and oceans (the abyssal life).

c **- coenogenesis** are the third path of biological progress. It is characteristic to the embryos and larval stages that are adaptations to the particular environmental conditions, which disappear with the passing of the individual stage of development.

d **- degeneration**or deterioration oforgans - the fourth path of biological progress is particularly significant (Severtsov, 1936). This path is due to major changes in the living environment, thus explaining the passing to sedentary or parasitic life. He stated that "*the four directions of phylogeny have the same value in that they all lead to biological progress, as a form of victory/success in the struggle for existence*".

Through each of these four paths of evolution, the number of individuals of a given species is increasing. The species areal is expanded and it is divided into new systematic groups (subspecies, species, genera etc.).

In other words, what is often labeled as regression or regressive evolution, is one of the ways to achieve biological progress. For the first time it has been observed that the phenomenon at the individual level, with apparent adverse effects to a certain organism, can have a positive effect at a higher level. As example, the level of the species and of the relations of one species with other species in the struggle for existence, in the struggle with the ecosystem to which it belongs. Going back to the criteria proposed by Ayala (1977, 1988) for what is meant by "better" in the definition of progress, we understand that he referred to the higher levels than the individual one, such as those mentioned by Severtsov(op.cit.) for the notion of biological progress.

Huxley (1953) developed a concept quite similar to Severtsov'sterminology and showed that biological progress is achieved through two main pathways:

a - **anagenesis** (equivalent to aromorphosis);

b - **cladogenesis** (equivalent to idio-adaptations).

In addition, Huxley (*op. cit*.) added the third way - **stasigenesis**, represented by persistent types or so-called living fossils. Regarding the criteria for making progress, Huxley (*op.cit.*) considered that progress can be limited or unlimited. According to him, man is the highest stage of evolution - a single line of unlimited progress.

Therefore, the progress of all groups should be evaluated only by comparison with the human. Limiting the progress of evolution to other evolutionary lines is due to the **morpho-physiological progress**ormorpho-functional features of those animals. Huxley's anthropocentric character in terms of biological progress is clear.

Mayr (1998) rejected the existence of a tendency of progress: "*There is simply no indication in the life history of any universal tendency towards evolutionary progress. If there is an apparent progresssomewhere,it is a result of the effect of change under the influence of natural selection*". Then, in 2001, Mayr changed his position. Although he stated that no genetic mechanism is known to generate any tendency for progress, "*However, progress can only be defined empirically, as achieving something that is somewhat better, more efficient and more successful than the previous stage*". He cited a few examples, such as the symbiosis that led to the emergence of eukaryotes, multicellular organisms, endothermia or homeothermia, the development of the nervous system, the care of chicks - which he considered "highly progressive". Mayr regarded all these traits as strictly individual and concluded that "**summing up these steps is evolutionary progress**".

That is, the survivors of this elective process proved to be superior to those who were eliminated. The final product of these "armored" can be an example of progress in biological evolution.

Futuyma (1998) separated the notion of tendency, from that of progress: "*Objectively, a tendency can be described as a change of direction over time*", whereas "*progress, on the contrary, implies improvement*", which makes sense as a value, to judge what "better" means.

Regardingthe idea that there is a global trend in the evolution of life, as the increasing complexity of living things or increase functional efficiency, Futuyma (1998) noted that there is no way to measure these trends. Therefore, "*It is probably wiser to say that in the history of evolution we could not identify uniform trends. Exceptions may be cited for any proposed trend*".

While different types of tendencies are objective realities (except for global tendencies), Futuyma (op.cit.) considered that: "*Progress usually involves a goal-directed movement, which in turn involves foresight. None of the mechanisms of evolution have been foreseen, and the processes of evolution cannot have a purpose*".

In addition, there are no objective criteria for evaluating improvements in the biological evolutionary process. In the absence of objective standards, we can say that amphibians are superior to fish or that man is superior to primates".

Smith (1988) has shown that: "*the concept of progress is an inappropriate name in evolutionary biology*." Smith and Szatmary (1995) published a subchapter entitled "*sophistry - error of progress*". They considered that there are at least two reasons to reject the idea of progress: - *the difficulty of defining the concept*; - *identifying the possibility of measuring progress*.

There is a desire to measure progress by the degree of morphological complexity and this would suggest evaluating the complexity of the number of cell types, and the amount of DNA coding. There is no reason why evolution through natural selection leads to an increase in complexity, if that is what progress means.

On the other hand, the same Maynard Smith (op. cit.) pointed out that although progress is not a universal law of evolution, "*... common sense suggests that at least some evolutionary lines have become more complex*" and has abandoned the idea of number of cell types, which he proposed as the sole criterion - the amount of DNA coding in the genome structure, although this indicator did not give satisfactory results.

There is an isomorphism between biological and technological evolution, both processes being oriented towards increasing structural complexity (Zavadski, 1970; Mayr, 2001). But isomorphism reflects only one facet and not the essence of the processes. Mayr gave the example of cars, whose structure has become increasingly complicated from the first model to the current ones. In fact, car manufacturers did not complicate the structure for the sake of complicating it, but because of the tendency to save fuel and increase efficiency in their use. Structural complexity is only the means of achieving the trend.

Similar trends also occur in biological evolution. The real teleonomy in this process consists in the development of such an organization that will lead to the increase of the energy supply in the system and to the increase of the efficiency in its allocation and use. Teleonomy could also be defined as direction of changing goal of structures and functions, due to evolutionary adaptations, assuming the organism's survival.

Accepting the idea that increasing complexity is the basic criterion for progress in biological evolution, the reverse of this idea appears - reducing complexity, simplifying the organization of evolutionary lines (*e.g.*, classical - parasites) would represent regression or a regressive evolution. But this idea is not consistent with reality. We mention that the isomorphism between the biological and the technical evolutions can also be observed under this aspect, of the structural simplification, which is in fact an opposite conclusion to the one supported by the biologists.

Continuing the example of cars (of the later electric cars) *a progressive step appeared through the structural simplification*, however, accompanied by the increase of the complexity of the electrical and electronic installations for operation and control.

Similar phenomena also occur in biological evolution: simplification under certain aspects is accompanied by increasing complexity under other aspects. The essence of both processes is the increase of energy efficiency, which in biology means the survival and prosperity of a particular species and this is a progress.

The evolution of Gould's opinion is significant for the clarification of the current situation on the progress in biological evolution. Gould (1988) considered that "*Progress is a bad example of a crucial generalization that we must follow - the study of directional change in history*". The term of progress is criticized for its anthropomorphic character and suggested replacing this notion with "operational" as a meaning of directionality.Gould (1996) in the book "*Full House*" categorically renounced the notion of progress and never mentioned directionality. He analyzed biological progress based on some important ideas:

First - Life appeared through bacteria, with a minimum level of organization(complexity) compatible with life. They can only evolve in the direction of increasing complexity.

The reality shows that, of course, bacteria did not evolve into more complex forms, but on the other hand, as in the more complex groups that appeared later, the tendency towards increasing complexity is not even more frequent than the tendency towards simplification of structure and, on the contrary, it has been observed on a very small number of evolutionary lines. The structural simplification of many parasites suggests this idea, although, as Gould admitted without comment, their frequent very complex biological cycle contradicts it.

Therefore, according to Gould (1988), increasing complexity cannot be a criterion for progress and where such growth has been observed, it was because of a random course of the process and not because of an active direction.

The second idea - Natural selection only determines adaptation to local living conditions : "*Natural selection can only produce adaptations (and changes) only to the immediate environment*".

The third idea - The rule of chance: "…*the desired progress of real life is rarelymoved away from small beginnings, without imposing a direction to an inherently advantageous complexity* ". And thus, with a strong irony, the most venerable evidence of general progress - increasing the complexity of the "*most complex organisms - becomes a passive consequence of growth in a system without a directional tendency in the movement of its components*."

Fourth idea - Dominance of the regressive trend of structural simplification in biological evolution.

Concluding this presentation of the current dominant situation in addressing progress in biological evolution can be expressed in one word - **discouraging**:

- the lack of objective criteria to define progress;

-the lack of quantitative evaluation methods of the processes involved (increasing or decreasing structural complexity).

The "better" criterion proposed by Ayala (1988) to define the progress, a criterion also accepted by Mayr (2001), without mentioning the entity to which they refer, did nothing but increased the confusion. It seems that the whole situation is at a standstill, after the conclusion of the two authors who have studied the notion of progress more closely.

Ayala (1988) came to the conclusion of the disheartening pessimism: "*If the term of **progress** had been completely canceled from the scientific discourse we would have been satisfied, but it did not seem to have happened*". Gould's position is similar to Ayala's. He categorically rejects the existence of the progressive tendency in biological evolution, of directional progress.

The main cause of this critical situation is the reductionist individualism in approaching the term. All changes (increasing or decreasing complexity - primarily the structural one) **are evaluated only with respect to individual life**. It would be so, only if the movement (towards increasing or decreasing complexity) would occur only in an ecological vacuum. But we know that reality presents us with something else.

Internal constraints, specific to individual organisms, may limit the possible ways of action of natural selection and select a certain direction of this action, whereby the ecosystem controls the direction and extent of evolution.

Botnariuc(2006) gave the example that the dominant groups of organisms that dominate today's biosphere are bacteria and insects. What do these two groups have in common? First, they produce nothing new on "vertical", but both of them have generated an unusual diversity on "horizontal".

This happened on two different paths, resulting from the intrinsic constraints that determined the direction in which the natural selection acted.

In eubacteria, the rigid cell wall did not allow the growth of the waist and phagotrophy, which led to external digestion and the extreme development of metabolic adaptability.

A similar phenomenon can be observed in insects. Their rigid (chitinous) external skeleton did not allow the growth of the waist or the development of the nervous system and of the internal structure in general, nor of the tracheal respiration, incompatible with the large waist of the animals. The evolution of this group has led to morphological and physiological diversification, the group being represented by most numerous species in the animal world.

It is clear that these intrinsic traits of bacteria and insects have influenced the direction of action of natural selection.

An important difference that needs to be clarified between these two groups is maintaining the stability of the structural type. The insects have surpassed it through the evolution of the organization of social life, thus surpassing the very limited individual capacity. Returning to Gould's idea of the notion of progress, Botnariuc(2006) appreciated that the idea according to which natural selection develops adaptations only to the immediate environment, reflects only part of reality.

Of course, adaptations may not appear to factors that are connected by organisms, but there are adaptations of some general traits (photosynthesis, phagotrophy, gnathostomy, breadth of O2 etc., as well as Severtzov'saromorphosis,which are opening a new and wide way of evolutionary progress of species.

Gould's assertion that the tendency to simplify structures, the so-called regressive evolution, predominates over increasing complexity does not reflect reality. The classic example refers to parasites, such as parasitic worms that have no digestive structure, sense organs or locomotion. Gould admits that the great complexity of the biological cycles of many parasites contradicts the idea of the predominance of regressive tendencies, but leaves the problem without comment. It is worthwhile that there are animals that live free and have simplified structures, such as parasites - without mouth, digestive tract, anus, locomotion organs.

There are animals (e.g., Pogonophora Phylum) which are free living and have simplified structures (as parasites are) - missing the mouth, digestive tract, anus, locomotory organs. Their common trait with parasites is that to get their food or energy they don't need the mentioned organs.

A whole Phylum Pogonophora with two classes (Vestimentifera and Pogonophora*s. str*.) are in this situation(Ivanov, 1960). The common feature of these animals with parasites is that their available food resource (energy) does notrequires the mentioned organs. Pogonophora(in both classes) are living in symbiosis with bacteria, in the vicinity of vents (outbreaks) on the bottom of oceans (Vestimentifera) and in the vicinity of methane sources (Pogonophora*s.str*.). The Vestimentifera Class is represented by 15 species, and the Pogonophora*s. str*. Class with more than 100 species.

It should also be mentioned that the species from PogonophoraPhylumare not the only animals adapted to live in the vicinity of ocean springs or at the bottom of the oceans. Complex ecosystems, with hundreds of species of molluscs, crustaceans, fish forms etc. in those trophic places, living directly or indirectly on the basis of bacteria as a primary source of energy and some of their organs, (especially the digestive organs), show different degrees of regression (Malakov, 1997).

Animals with lifestyles and structures similar to those of the pogonophores are known, but they also live in other environments, such as marine muds and sediments in salt marshes and marshes, all these environments being reductive (Cavanaugh, 1983).

In relation to the idea referring to the predominance of the simplification tendency of the structural complexity, over the tendency of growth (of the complexity) it is forgotten that most of the times, the change of the environment and the way of life lead to the simplification or even to the disappearance of some narrow structures. They are accompanied by the increase of the complexity of other features or processes that mean to fulfill the same functions, in the new environmental conditions or to fulfill new functions, required by this new environment. The essence of these changes at the individual level is the same: the use of available energy sources, which allow populations to live, probably even to thrive in the given ecosystems.

Here are some examples of decreasing complexity, accompanied by its increase:

1 - Comparison of a unicellular organism with a metazoan cell shows that"*... the most typical metazoan cells appear to be average in Mayfly less complex than typical free-living cells*" (McShea 2001). On the other hand, we notice that in the cells of a multicellular organism, new structures appear or are formed, in relation to the organism's life (*e.g*., liver, muscle, nervous cell, etc.).

2 - Origin of animals from the PogonophoraPhylum(with fossils fromCarbonifer) is not yet fully clarified. Their internal morphology is on the one hand simplified, similar to parasitic worms, but on the other side, they appear to be much more complex, both structurally and functionally (Ivanov, 1960;Malakhov*et al*., 1996; Malakhov, 1997). The cells of their trophosomes are populated by bacteria that are dividing when they become mature and become a source of food for the host. Bacterial metabolism is different in the two classes:

a - in Vestimentifera Class, bacteria oxidize H2S and use energy to synthesize the organic substances they need;

b - In Pogonophora*s. str*., the bacteria oxidize CH4 released from the cracks in the ocean floor. It is obvious that the decrease of the complexity of some organs is accompanied by the increase of the complexity of other organs.

3 - The last example concerns Cetacea Order. Although their exact origin is not yet fully clarified, it is known that they were coming from terrestrial mammals during the Eocene (55 - 57 million years ago). By adapting them to the aquatic environment, some structures have been simplified, others have disappeared (hair; salivary glands; skin glands; hind limbs have reduced; at whales, the pelvic bones are gone), while other structures have increased in complexity and new structures formed: for chemoreception; the change of the hearing aid; the increase of the stomach's complexity (with 3 - 14 compartments); the development of an air storage mechanism and thus allowing them to stay submerged for more than an hour; modification of the dental wall by the formation of fanons(at Mysticeta); metabolic adaptations to water with marine (salt) water; development of organs for ultrasound communication (echolocation) etc. In fact**, decrease in complexity of some organs is followed by complexity increase and even by appearance of new organs**.

There is a new point of view, based on the analysis of the animal's role in biosphere evolution.In order to conclude this brief review on current views on the progress in biological evolution, we oppose a new point of view, based on the analysis of the role of animals in the evolution of the biosphere. These new views aregeneratinge much optimism in solving the problem and open new horizons for investigations.

This change is due to Por (1994), who in his book "*Animal Achievment. A Unifying Theory of Zoology*" investigated progress in evolution. After that,hegave several lecturesand in each of them was absolutely delimited by reductionism, dogmatism and catastrophism which still dominates the idealists.

Por (*op. cit*.) started from the idea that the biosphere is an open and dissipative thermodynamic system, in which structures evolving that consume the increased amount of energy and whose information content is also increased. The entire process of evolution of the biosphere is directed by natural selection, starting from the molecular biochemical level to the Kingdom.

Due to the positive *feedback*, this evolution is fast developing. With the advent of the animal world, "…*the speed of energy processes in the biosphere and thus the speed of evolution itself have increased considerably*" (Por, 1994).

What characterizes the activity of animals (or animality in Por's terminology)? "*The existence of animality in the biosphere context is the aggressive consumption of living organisms, the sensory capacity to detect the food resources, the mechanical means of predating and the freedom of movement in different environments, to search for food*. ***Improving these capabilities is the measure of the progress of animal evolution***". This tendency of progressive improvement of "animality" is, however, far from being universal in the animal Kingdom."*Many branches of the animal world have been divided in specialized directions, such as the progressive improvement of adaptations to the sedentary lifestyle or to the parasitic life*"(Por, 2003).

The diversification of the animal world leads to the development of complex trophic relationships, with long trophic cycles, accelerating the recycling of matter. An important moment in this process is the transition of many animals to the consumption of plant food (cellulose) in symbiosis with anaerobic bacteria.This "harpactic" activity (term proposed by Por for the predatory nature of animals), in all trophic cycles leads to the development of mechanisms of defense in plants and animals: physical, chemical, behavioral/habits mechanisms.

Increasing the energy supply by expanding the biosphere due to both terrestrial vegetation and the growth rate of recycling resulting from animal activity leads, on the one hand, to a considerable increase in global biomass and, on the otherside, to a more stable equilibrium of the composition of the atmosphere, in which CO2 consumed by plants, with the release of O2 is returned by the respiration of the animals. The emergence of thermoregulatory vertebrates (birds and mammals) - the largest energy users - represented a new qualitative stage in the evolution of the biosphere. If birds, with their entire morphology and physiology strictly specialized for flight are a dead end for evolution, mammals (including humans), represent the latest peak of evolution. Por (2003) believes that "…*with the advent of man, the process of evolution has ended*".

The essential question is whether a certain general tendency in the evolution of life can be discerned. If YES, then what is its progressive character, what is the evaluation criterion and what are the forces that determine this process?

The answer to all these questions is Por's (1994) original contribution to analyzing and solving the problem of progress in biological evolution. After him, "*Animal life has evolved progressively, to the highest level of complexity and the most subtle habits*". This progressive character is the result of a given tendency: "…*the biosphere expanded, thickened and became more complex structured as a general tendency to organize matter on the living planet Gaia*".

The Gaia hypothesis considers that living beings interact with abiotic factors (with inorganic matter) on Earth and form a complex, synergistic, self-regulating system that helps maintain and perpetuate life on the planet.

Here is the answer to the criterion and the factors of the evolutionary process:

a - the objective criterion is undoubtedly the improvement of the"animality";

b - the improvement of the structure of the animals, the growth of their organization and the ability to fulfill their role as global energy traders.

"*The driving force of zoological progress is mainly ecological: expanding and improving energy progress in the biosphere*" (Por, 1994).

As Por(*op.cit.*) stated, the natural selection drives the entire evolutionary process from the molecular level to the Kingdom. The species have the main place in this process. "*What the daily fluctuations of the environment do is the selection of the species, with strong convulsions in the selection at the level of the classes and phylum*". There is a tendency in the evolution of animals to increase the structural complexity.

First observation is that natural selection is a fact of the ecosystem - resulting from the interaction between populations and abiotic factors in the ecosystem. The direction of action of the natural selection is the adaptation of each population in the ecosystem to its structure and functions (constraints). The individuals that make up the populations resist the mechanisms of action of natural selection, because they are the only ones with metabolism, capable of ensuring the exchange of matter and energy with the environment.

If this is the case, then there should be no tendency for structurally-functional growth or decrease (structures & functions) of organisms, but only the tendency imposed by the ecosystem, of maximizing the input and of minimizing the energy consumed in the activity of each organism. This is done by any means, either by increasing complexity, or by structural simplification or often by mixing these two tendencies, if this leads to the improvement of the energy budget, ensuring the success of survival and reproduction in the given population.

The second observation is taking into account the hierarchical structure of biological systems.We observe that natural selection acts on several levels. The levels of this action are often different and different levels are contradictory. A trait useful for the survival of a species in a given ecosystem can have adverse or even fatal consequences on the individuals that make it up.

Facts: - The aphids (Order Hemiptera) and adults of the order Ephemeropteraor Mayflies as well as in the family Chironomidae (Ord. Diptera) are including several thousand species.

- Hypertelia of many species of invertebrates and vertebrates.
- Reduction of some essential organs in many parasites and in many sedentary organisms.

Question: Despite the reduction or even disappearance of vital organs to ensurethe prosperity of those species, can the progressive effect of their evolution be denied?

Of course, as Por (1994) said, selection at the species level is also reflected at the levels of classes and of higher taxa. However, due to the lateral transfer of genetic information, the possibility of the monophyletic origin of large taxa is questionable. Notwithstanding this idea, we can say that taxa belonging to a class or lineage have in their genome part of the common heredity, but that each component taxon of a lineage has its own path of evolution. This is the consequence of the fact that the **evolution of life is not a unilineal process** (like the marathon - after Por's comparison). The evolution isnotananthropocentric process, but a process that takes place on multiple and divergent paths. Those paths are representing history, more precisely - the precondition of the current situation or the history throughout which genome changes occurred.

As examples are the human species preconditions:

- the adaptation of the primates from their origin, to the arboreal life;
- the placement of the eyes in front (convergence to all the carnivorous mammals and to the birds), allowing them the stereoscopic view, necessary a correct evaluation of the distances;
- the prehensile structure of the limbs;
- thumbs-up opposability;
- use of hands to grab food and even to use tools;
- use of legs for support.

All these traits were the preconditions for moving to life in the opened places of the savannahs, where tall grasses with large carnivorous animals (another precondition) imposed a bipedal posture, which allowed them to observe those carnivores; the release of upper limbs, with all the consequences. This evolutionalso involved changes in the structure of the genetic background.

If, asPor (2004) said, on this planet this trajectory of the evolution of life and the appearance of the human species were inevitable and necessary, it is difficult to imagine the possibility of a replica on another planet in our solar system, the only one among other solar systems.

This is one of the reasons why we cannot agree with Por's optimism about the future and role of humankind’s evolution: "*Humanity is the leap to produce the breakthrough in capturing and transforming energy on the globe, both through the transgenic growth of primary production and by liberationnew sources of energy, such as hydrogen burning and atomic fusion*"… "*The humans ... will survive and dominate the globe until it begins to be sunk by a gigantic red sun. By then, humanity will have already colonized space*”(Por, 2003).

At the conclusion of the discussion on this topic, we mention the opinion of Budyco (1984) based on his own investigations and the analysis of an abundant literature. In the investigation of the biosphere’s evolution it must be taken into account that the area of life, meaning the range of physical and chemical conditions that make possible the existence of living beings is very narrow, compared to the variability of these conditions on the celestial bodies. This area is even narrower for different species and their groups. Therefore, "*... the external factors of the evolution of the biosphere act on it independently of the existence of life on Earth, preserving the biosphere and its progressive development over billions of years, as has been seen, there are events whose possibility is very low. That is why the prospect of discovering extraterrestrial life or civilization is quasi-null*”.

But we can say that both positions, optimistic and pessimistic, have a strong speculative character so far. However, judging by the cold, the current evolution of the biosphere and the role of mankind in this process do not show that the optimism is justified. On the contrary, global phenomena, such as the case of climate change, pollution of all living environments, overexploitation of natural resources, risks of pandemics and not only, are causing a dramatic reduction of biodiversity, thus slowing the process of removal from the state of thermodynamic equilibrium.

Moreover, after Botnariuc (2005), the extension of the desert areas shows the reverse of this tendency on wider surfaces: the closing of the state of the thermodynamic balance.

II. Increased energy supply and energy efficiency - fundamental trend in the evolution of biological systems.

As it has been shown, from a thermodynamic point of view, biologicalsystems are in third state. In other words, they tend to distance themselves from the first state (of the thermodynamic equilibrium), having the possibility of increasing the energy supply in the system, which is reflected by the increase of biodiversity. This trend appeared with the first living beings. So far we do not knowexaclty how life on Earth appeared, but we know that this event took place approx. 3.85 billion years ago.

Some authors (*e.g*., Moorbath, 2005) argue that the oldest bacterial fossils in the Gunflint formations in Ontario - Canada are of only 1.9 billion years old and that they were preceded by a long chemical evolution, which has been experimentally proven by Fox (1988).

We also know that the first living organisms that appeared on Earth were bacteria - the only components of the biosphere for over two billion years. For most of that period, the Earth's atmosphere was completely or almost completely devoid of oxygen and therefore the bacteria were anaerobic for a long time.

The efficiency of anaerobic metabolism is lower than the efficiency of aerobic metabolism: under aerobic conditions, from the same amount of glucose, 19 times more biomass is formed than under anaerobic conditions. This increased efficiency is very important, because biomass is a source of energy for other organisms. Under anaerobic atmosphere, bacteria began to fix free nitrogen, which is indispensable in protein synthesis.

A first qualitative change in the biosphere energy, an event that we can consider as the **first ecological revolution**, took place when the first organisms capable of oxygen photosynthesis appeared.

It must be said that before this event there were anaerobic photosynthesizingprokaryotes. It was anoxygenic photosynthesis, in which H2S was the source of H to reduce CO2. It is important to note that during the anoxic period, oxygen was used in metabolic processes and therefore was not released into the atmosphere. Then the source of hydrogen was limited.

A radical change occurred with the emergence of oxygen photosynthesizing Cyanobacteria, in which H was produced by the photolysis of the water - unlimited source, and O2 was released into the atmosphere. The deposits of Cyanobacteria, the so-called stromatolites are known in fossil state from rocks of 3 billion years old. They are also formed today, in the supersaturated waters of the tropical climate zones.

The assault of oxygenic photosynthesis had numerous and profound consequences on the future evolution of the entire biosphere. Thus, the concentration of oxygen gradually increased both in water and in the atmosphere. Therefore, an increased influx of energy into the atmosphere followed. However, the process was very slow: the current concentrations only reached in Cambrian (545 million years ago), that was, after about 3 billion years.

Because oxygen was toxic to anaerobic prokaryotes, they either began to withdraw into anaerobic environments or developed mechanisms to neutralize oxygen toxicity and adapt to aerobic conditions. The accumulation of biomass increased markedly and therefore the solar energy was retained in the synthesized biomass.

Cyanobacteria also have structural changes, with important physiological and ecological implications. Thus,besides the unicellular species, filamentous species appeared - the first overindividual organizations. Moreover, in the filamentous organisms, cell differentiation has appeared:

- **akinetic cells** - which are resistant to some abiotic factors (to temperature changes, for example);
- **heterocysts** - with thickened walls to prevent the penetration of oxygen and made possible the nitrogenase activity and thus fixation of nitrogen molecules, which then diffused into all filamentous cells. This was the first structural feature that allowed the integrity of the colony.

Meanwhile, another radical change has occurred in the evolution of biodiversity - the emergence of monocellular eukaryotes, from the symbiosis between Archaebacteria - capable of phagotrophy - and photosynthesizing Cyanobacteria. The oldest fossils of eukaryotes are 1.5 billion years old. Paleo-chemical analyzes have shown the presence of sterols that are characteristic of eukaryotic membranes in geological formations of 2.7 billion years (Grotzinger and Knoll, 1999).

The appearance of eukaryotes has brought some important innovations:

- the first appearance of complete cells, with the nucleus included in a membrane, surrounding the nuclear chromosomes;
- the eukaryotic cell has specialized organs (mitochondria that fulfill the respiratory function;
- chloroplasts that carry out the process of photosynthesis);
- although many unicellular eukaryotes still have asexual reproduction, the sexual process appears for the first time, which is a very important innovation;
- due to the symbiosis between Archaebacteria with different Cyanobacteria, eukaryotes have

polyphyletic origin.

All these innovations have brought profound changes in the biosphere energy. Firstly, due to the increase of biodiversity, the contribution of energy increased. This growth was achieved in two ways:

- the diversity of symbiont combinations;
- their diversity on account of genetic recombination, resulting from the sexual process.

Then, the increase of the energy efficiency also increased in two ways:

- the efficiency of the aerobic metabolism by which more energy was obtained from the food;
- active nutrition or phagotrophy.

These phenomena had important ecological consequences:

a - based on phagotrophy (harpactic activity), the first trophic cycle was established. This cycle activated the recycling of matter and increased the speed of biomass accumulation. The biomass is the source of energy and the factor of accelerating the flow of energy and the evolution of life;

b - unicellular eukaryotes have been the most evolved group for hundreds of millions of years (up to the Precambrian), when in a rather short time (on a geological scale) there was an "explosion" or flowering of metazoans;

c - in the Precambrian, all the current taxa appeared, as well as other taxa, which in the meantime disappeared.

Undoubtedly, the Cambrian explosion was a long process, but those bodies without skeleton left no traces.These situations are showing that energy allocation is not only dependent on the mentioned factors, but also by occasional phenomena from the biological cycles of those particular organisms.All these variations are changing energy budget ratio of certain organisms and the value of their parameters can be quantitatively determined both at the individual and at the population levels.

How can this spontaneous flowering of life forms be explained after several billion years since their emergence and after a very slow evolution?

The appearance of the multicellular organisms was the result of the increase of the energy supply in the biosphere, a phenomenon that was possible with the increase of the oxygen concentration in the atmosphere. Near Cambrian, this concentration reached the current level of O2 in the atmosphere and thus it was possible to diversify life forms (Knoll and Carroll, 1999; Knoll, 2003).

Biodiversity and its growth in the entire hierarchy of biological systems has been and remains the most important way of increasing energy input in the system, thus distancing the global system from the state of thermodynamic equilibrium.

Which are the ways of increasing biodiversity?

- Mutational and phenotypic variability.
- Genetic recombination due to the sexual process.
- Transfer to the gene pool.
- Endosymbiosis.
- Intrapopulation diversity - by age, waist, habits, feeding, defense.
- The interpopulation diversity due to the different activities of each species in different ecosystems.
- Speciation, in all phases - emergence of breeds, subspecies, species.
- Diversification of species at a certain trophic level has led to the diversification of species of all lower (subordinate) levels.

Odum (1989) highlighted the stabilizing role of the functional redundancy of the primary producers in the functioning of the ecosystems. To this role it must be added that the food (biomass) resulting from the primary production differs *qualitatively* from one species to another. The diversity of food is a significant stimulus to increase the consumption of biodiversity. Thus increases the energy supply at all trophic levels, which finally has a significant increase in the energy supply in the biosphere.

The methods of increasing the energy supply and the efficiency of the use of energydiffersinbiological systems at different levels. They are depending on the following factors:

- position in the hierarchical system and phylogeny;
- the conditions of the abiotic environment;
- the waist of the organisms;
- the feeding mode;
- position in trophic cycles;
- the reproduction strategy.

Here are some ways to increase the energy supply at the individual, population and at the ecosystem levels:

At the individual level. Individual organisms operate in accordance with the principle of maximum energy intake and minimum energy and time expenditure. This is done in the following two ways:

a - The development of morpho-physiological features and their specialization for various functions lead to the positioning of the body as a whole, to a higher level and to a higher efficiency. Phagotrophy and then gnathostomy made feeding an active process, with increased energy efficiency. These transformations were correlated with other transformations, such as lung respiration, separation of venous by arterial circulation, development of homeothermia, increased independence from variations of the environmental factors.

b- An original way of increasing energy intake can be seen at some groups of animals, in which combinations of functions (*e.g*., breathing and nutrition) are energetically essential. These phenomena can be observed in the filtering organs: branchiopods, lamellibranch mollusks, many sedentary animals and in general those beings in which the breathing and catching of the food are carried out by the same organ, as it is the case with the locomotion organ in the branchiopods. Because the breath is a continuous process, so does the feeding.

At the population level, three new ways of increasing the energy supply have emerged:

a- Ecological diversification of ontogenetic stages - polymorphism and the polyphenismor phenotypic plasticity of these stages, which lead to the diversification of the consumed food, to the adjustment of the number of chickens according to the availability of food resources, to the social hierarchy that sets the priorities of access to food.

b - The emergence and evolution of society in invertebrates and vertebrates has greatly increased the energy supply. The "schooling" of the brood in many species of fish and other vertebrates educates the chicks how to find food faster and how to defend themselves better. Hunting in packs, organized in many species of carnivores (wild dogs, hyenas, wolves) allows them to hunt more efficiently the large herbivores. Moreover, in some species the food is shared with the individuals who remained "at home" (the sick, the females with chickens).

c - In invertebrates, the height of sociality is reached by two orders of insects: Isoptera - termites and Hymenoptera - especially bees and ants. Their social organization allows them to exceed their individual capacities. Some of these insects (Termitidae between termites and the Attini tribe of ants) organize mushroom breeding farms as a food source. In other species, inter-individual collaboration allows them to hunt larger animals, inaccessible to isolated individuals.

At the ecosystem level which is a large-scale ecological revolution, including in the biosphere's energy, occurred with the emergence of terrestrial vegetation (in Silurian) and then developed rapidly, so that trees appeared immediately in Devonian (Valentine, 1977). These events led to a strong increase in the contribution of energy to the biosphere. Thus, mineral sources on the surface of continents began to be used and this led to all cycles of bio-geo-chemical transformation. This revolution was quickly followed by the explosive development of insects.

Biodiversity - the essential mechanism of increasing energy input, has accelerated its growth through positive *feedback*. The functioning of this mechanism was very well rendered by Ayala (1988): "*The more species, the greater the number of environments created to be exploited by the new species*".

Once the plants appeared, the existence of the animals was ensured, and they support a large number of other animal species that became predators, parasites or symbionts.

III. Allocation of energy

In the structure of trophic cycles, each population - both energy users from available and accessible sources, as well as biomass producers -, are becoming source of energy for other consumers. This activity, characteristic of each population is the specific message (information) transmitted to the ecosystem, which "evaluates" the compatibility of these activities with the structure and functioning of the entire ecosystem. This is the process of natural selection, an emerging process of the ecosystem, which determines the direction and intensity of the activity of a population and the evolution within the limits allowed by the intrinsic factors of the individual components.

In this context, the essential strategy of each population, as a result of natural selection, is to preserve the integrating ecosystem. For the realization of this strategy, a major factor is the different allocation of the energy supply for the different functions.

The individuals of a population have two essential functions:

a) - individual survival, with all the functions of identifying food, feeding, digestion (processing) and assimilation which means extracting and preserving energy;

b) - reproduction that ensures the survival and maintenance of the population.

Wilson (1975) presented the results of the researchers of that time, regarding the allocation of energy budget to vertebrates, for different functions. Investigations were carried out on 4 species of fish, 6 species of amphibians, 3 species of reptiles, 7 species of birds and 7 species of mammals, and it was found that in most species, feeding was a priority in the allocation of energy, after which reproduction followed, including post-reproductive activities.

Of course, the data presented are too few to be generalized, either only to vertebrates, but they are the only ones for the world of plants and animals. The facts show that the allocation of energy varies greatly depending on a few factors, such as:

- position in trophic cycles;
- breeding strategy ("*r*"or "*K*");
- the way of life (*e.g.,* sedentary, parasitic);
- the abiotic and biological environment.

Thus, the species with the strategy "*r*" of reproduction, most of them being located at the base of the trophic cycles (all prokaryotes, protists, many metazoans) are lacking effective defense mechanisms and therefore, their capture by predators is not selective. Thus, most of the energy is allocated to reproduction, to produce as many descendants as possible, thus ensuring the survival of a particular species. For most plants with the "*r*" strategy of reproduction they have their energy source provided by photosynthesis. Many plant species have efficient means of defense: **physical means** - thorns and spines; **chemical means** - toxic, poisonous substances.

All these are effective in defending against predators, which could endanger the existence of the population (Botnariuc, 2003). Plants use energy mainly for the survival of the body and only then for reproduction.

The priority of energy allocation for individual survival is observed only in special situations. For example, in the Danube Floodplain, when spring floods are high water levels and long lasting, the reed (*Typhalatifolia*) spends most of the rhizomes energy to reach the surface of the water, having to grow and restore reserves of energy from rhizomes. In such years (with long floods) the reed does not bloom and does not seed, because the energy reserves of the rhizomes are not sufficient for the function of these energy-consuming greens (Botnariuc, 1963, 1967a and 1967b).

Such factors show us that the allocation of energy depends not only on the factors mentioned, but also on the occasional phenomena in the biological cycle of those particular organisms. All these variations change the ratio of the energy budget of the respective organisms, parameters whose value can be determined quantitatively both individually and at the population level.

IV. Conclusions

1 - Analysis of the current situation of the problem of progress in biological evolution proved that there is a critical situation. The true cause of this situation should be the individualistic-reductionist manner of tackle the whole problem, which, with few exceptions, dominates the thinking of biologists.

2 - This deadlock may be due to a change in thinking towards systemic conception, taking into account the energy of biological systems throughout the hierarchy, from individual organisms to the biosphere.

3 - As it turned out, there are some encouraging signs. But these attempts to overcome dominant dogmatism are held in silence. It is another kind of *tacit veto* and this is because of aninadequate thinking policy.

4 - The biological evolution approach taking into consideration the structure and the hierarchical relationships of the biological systems and their anti-entropic character, explain their tendency to move away from the state of thermodynamic equilibrium and this should be the way out of the blockade (from the dead point).

5 - There is no preferential tendency of biological evolution in the direction of increasing or decreasing complexity, but only the tendency to maximize energy capture in the system, which is done in different ways at all levels - from the individual to all ecosystems of the biosphere.

6 - Whether the structure of the organisms that make up the population and whether the structure of their biological cycle is simpler or more complicated, it allows the maintenance and prosperity of the population in a given ecosystem, by participating efficiently in the ecological flow and satisfying its material and energy requirements, so that the species can prosper or can make progress.

7 - Globally, increasing biodiversity is the most efficient means ofincrease the captured energy and thus the ecosystem to move away from the state of thermodynamic equilibrium.

8 - To capture energy and allocate it for different functions of individuals and of the population are processes that can be evaluated quantitatively and they are a basis for evaluating progress in biological evolution.

9 - Through its intraspecific relationships, through its destructive habits in relation to the whole biosphere, through the lack of self-control,through all its activities and pressures, the human species disorganizes the biosphere, undermining the bases of its indefinite existence. 10. In the above mentioned conditions, the evolution of the biosphere is no longer biological and human species could no longer be biological.

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