MAN AND LAW IN EVOLUTION

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To answer the questions proposed by this forum, I have to outline my current studies on "the laws of evolution," which takes place in the framework of environmental studies and history of science. A simple observation will become a starting point of my research: No chemist will tell that copper originated from iron through selection of small variations during the adaptation to the best temperature of melting, although in biology similar statements are normal. Natural sciences contain numerous laws, while in biology the laws tend to be replaced with speculations. The attempts to reveal the laws of evolution, which would be similar to the laws of chemistry and physics, were undertaken mainly within a framework of the directed evolution concepts (orthogenesis). The advocates of these concepts claimed the following: Living organisms have a predisposition to vary in certain directions, and this very predisposition determines trends of evolution first of all; as crystals grow taking a certain form, so phylogenetic trends evolve following internal laws. This idea was first formulated clearly in the second half of the nineteenth century. In the years that followed, new versions of directed evolution appeared regularly till today. They were usually counterpoised strongly to Darwin's theory. However, now the idea of directed evolution is penetrating "through the back entrance," even through studies conducted in terms of natural selection theory. New Darwinian concepts reminding orthogenesis were elaborated: "developmental constraint," "generative entrenchment," "epigenetic traps," "evolutionary ratchet," "design limitation," "development and design limits," "spontaneous order," "crystallization of life," "evolutionary channeling," "non-random production of variants," etc. The authors of these concepts do not consider themselves advocates of orthogenesis, yet they claimed either the possibility of self-organized autonomous evolution without selection or the existence of some internal forces in evolution. Such hints of orthogenesis deal mostly either with hypothetical organisms (modeling without any illustrations by real examples), or with the very remote past (pre-Cambrian), or with the minute details of the structure of some organisms (e.g., the fingers of some

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salamander species or the differences in spot-patterns between segments of the *Drosophyla* body). The directed evolution idea is not allowed to penetrate the foreground of evolutionary theory, but it has progressed over last 150 years.

The appearance of the directed evolution concepts was usually caused by the analysis of the following phenomena: convergences inexplicable in terms of adaptation, constraints on variation, evolution of non-adaptive characters, the trends of evolution leading to extinction, the origin of novelties. Analyzing such phenomena, the advocates of the directed evolution idea proved the fact of "directionality," albeit they usually did not characterize clearly its mechanisms. Many of them just claimed on the existence of laws of biology, or admitted that the mechanisms of directionality are unknown. In modern science the term "constraints" seems to correspond to these "laws of evolution." However, constraints only partly explain the mechanism of directionality. Besides those constraints some internal forces exist, that move evolution on roads created by constraints. In this connection, the first advocates of orthogenesis introduced numerous special terms to characterize this phenomenon—"batmism" (E. Cope), "aristogenesis" (H. Osborn), "autonomous orthogenesis" (L. Berg), etc. The modern authors follow this "tradition," although now it is not necessary anymore, since it is already known that variability possesses the properties corresponding to such "mystical" forces: it takes place inevitably and continuously. It happens at least due to of the complexity of processes involved in reproduction. Some failures of reproduction are inevitable, as the organisms cannot reproduce exact self-copies for a long time.

Hence, the mechanism of directionality of evolution could be characterized as follows: organisms inevitably tend to produce copies of themselves, but they are incapable to reproduce their exact copies; that is why species transform inevitably with the changes of generations, even if they are already well adapted to their environment; such a continuous transformation takes place in definite directions caused by various constraints, even if these directions are not rational or lead to the species extinction. The role of natural selection is limited, since on one hand, it has not abundant material because of constraints, and on the other, it has not enough time because continuous variation. This means that the majority of species representatives participate in the evolution rather than a selected elite which force out their relatives.

Assuming the existence of the mechanism characterized above, the human evolution might take place spontaneously irrespectively of our desire. In a moment our species might be transformed into other(s), or become extinct without any descendent. There are some evidences on the second scenario: 1. In comparison with other hominids, the human species

has an origin due to a giant specialized form. The appearance of such forms indicates on the forthcoming extinction of a phylogenetic trend. 2. The current stage of hominid evolution demonstrates the decreasement of the species number to a minimum. This also takes place at the final stage of a trend. With all this going on, the change of the human environment occurs in that direction, which is hardly favorable for mankind.

It may well be that humankind is able to control the process of its own evolution, but now it isn't doing so. All eugenic programs came to a dead end. Moreover, the human species is even incapable to control the activities of big groups of its representatives. During the last 40 years the human population doubled, 20 per cent of the topsoil has been lost, wars and other non-rational human activities have not disappeared. A quarter of mankind lives in poverty. The care for the biosphere and human evolution is not the prime interest of those groups of mankind. All this is not rational, and means that in many respects human species behaves as every other animal: It increases its own population to the maximum consuming all possible kinds of resources, not taking into account whatever information about the perspectives of such tendency. Mankind exterminates not only the biosphere objects which oppose his activity, but also those objects which could be used with to its benefit. The history of fisheries demonstrates one of the most remarkable examples of such non-rational activity.

The capture of fishes and other water inhabitants have been continuously declining over the last centuries. The scale of such a decrease was only recently realized. Usually the representatives of one human generation are well informed only on the situation existing several decades before them. They consider that situation to be perfect, not realizing that it was much better hundreds of years ago. Nowadays, enthusiasts on ocean wildlife restoration accept a slogan: "shifting baselines," i.e., they appeal to realize the catastrophic decline of biological resources. It would seem that if the "baselines" are known, it should be easy to elaborate a rational strategy: To restrict the capture, to wait some years, and than to use fish populations rationally in accordance with the well known regularities of the population dynamics. Anyhow, mankind is incapable to do so. Even the developed countries cannot control the groups that want to catch fish. The fisheries will stop only when the fish population runs out, i.e., when fishery becomes non-profitable. The only way to solve the problem is to organize fish breeding. Why do we need to breed fishes, if they could reproduce and grow by themselves? Only uneducated persons are now allowed to express such a viewpoint, while an "intelligent" man is guided by another: "Why must we prohibit something to ourselves as to just catch fishes, if we can breed them?" This last viewpoint could seem rational, but fish breeding is expensive, labor-intensive and ecologically inappropriate. It requires technologies, bureaucracy and scientific research, where each

of such components tends to be more and more complex. Moreover, those components appear inevitably, and pretend to contribute to the fish production while in reality they just support their own existence. If huge funds were spent on the protection of populations and purification of water, which are spent directly or indirectly on fish breeding, the ecological and economic effects would be much higher. However, the self-developing system as a strategy was firmly established. It approaches the end of the natural existence of many fish species. Thousands of years ago man undermined the populations of numerous land animals and was forced to domesticate some of them. Nowadays it should be the fish's turn inasmuch as the vast spaces of ocean are already similar to the Sahara desert. The essence of the human species activity has not changed over thousands of years. The most remarkable feature of such an irrational behavior is that human species always chooses the activity that contributes directly or indirectly to the increasing and perfection of technology. This fact could be considered not as reproduction and perfection of technology for mankind, but on the contrary: that technology is reproducing by means of mankind and directing the evolution of biosphere. Mankind hardly notices such a process; that is why it is in a danger to fall into a "hundred year solitude": the secret could be open only when it would not have sense any more.

From such conclusions I can answer the questions stated above very briefly: Any development of knowledge changes the essence of human activity. This activity seems to be predetermined and subordinated to laws similar to physical and chemical ones. I am aware of the unpopularity, unpleasantness and peculiarity of such a viewpoint, but for now I cannot make another conclusion. Maybe the studies that should follow would force me to change it.

REFERENCES

Popov I. (2002), "Periodical systems in biology (a historical issue)," *Verhandlungen zur Geschichte und Theorie der Biologie* 9: 55-69.

Popov I. (2005), *Orthogenesis versus Darwinism: A Historical Issue*. Saint-Petersburg: Saint-Petersburg State University. (In Russian with an English summary.)

Popov I. (2006), "On the program 'Ñontours of Evolution': How to generalize everything?" *Philosophia nauki (Philosophy of science*) 1: 3-17. (In Russian with an English summary.)

Popov I. (2006), "The American Northwest salmon crisis", *Problems of fisheries* 1: 61-72. (In Russian with an English summary.)

Popov I. (2006), "Directed evolution of mankind and biosphere," *Impact of Radiation Risk in Normal and Emergency Situations*. Arrigo A. Cigna & Marco Durante (eds.). NY: Springer Verlag.