

COMMENTS ON IGOR POPOV'S BOOK *Orthogenesis versus Darwinism*¹

Springer International Publishing AG, part of Springer Nature, Switzerland, 2018

Georges CHAPOUTHIER²

For a long time now, arguments opposing blind evolutionary processes to predispositions in the evolution of living organisms have been a subject of conflict in theories propounded by biologists. Darwinism, as described by Popov, is based on the idea that “evolution occurs due to selection from a large or an almost unlimited source of variability and that its direction is determined by adaptation to a constantly changing environment” (p.1). Arguing against this Darwinian stance, “an alternative viewpoint implies (...) that organisms are predisposed to vary in certain directions and that this predisposition is the determinant of evolution” (p.1). This is orthogenesis. “The ideas of directed evolution date back to antiquity but orthogenesis as an articulated evolutionary concept emerged in the second half of the nineteenth century” (p.2).

It should, however, be stated here that Darwinism for Popov is modern Darwinism, whereas Darwin himself, with natural selection, did not explicitly refute the Lamarckian argument that acquired traits may subsequently be passed on through heredity. Popov observes that arguments in favour of directed evolution as presented by von Nägeli could not really be explained by Darwin “in terms of natural selection” (p.22). Thus, in the controversy of natural selection versus directed evolution, Darwin was mostly silent, but what did he reply to advocates of directed evolution? “Strictly speaking, almost nothing. He was much more interested in other problems and could not address all the objections he received” (p.21). In certain situations (p.25), Darwin’s remarks suggest that he had not dismissed the possibility that the acquired traits of parents might have a certain influence on their offspring, a point of view generally considered to be Lamarckian³, although Popov maintains that Lamarck’s views were more complex than this simple and classical hypothesis: “Lamarck indeed wrote about exercises and action of the environment upon evolution but never used the terms ‘heredity’ or ‘inheritance’” (p.177). Whatever the case may be, in Popov’s book, Darwinism should always be seen as modern Darwinism, in clear opposition to Lamarckian stances.

Popov brilliantly describes the history of directed evolution leading to orthogenesis: Lamarck, Cuvier, von Nägeli and others. Popov’s review of the literature author by author is both extensive and well analysed, highlighting multiple interpretations of the word “orthogenesis” in sometimes very different contexts: “The term *orthogenesis* was ambiguous from the very start” (p.27). The arguments

¹ See the jacket for this book below.

² Le Centre national de la recherche scientifique, Paris, FRANCE.

³J.B. de Lamarck, *Philosophie zoologique*, Flammarion, Paris, 1999.

continued, and by the early 20th century, the term “orthogenesis” had become popular; “new concepts of directed evolution were born in Russia (nomogenesis, historical biogenetics), the USA (aristogenesis), Austria (apogenesis), France (allelogenesis), Italy (ologogenesis)” (p.31). In all these new terminological endeavours, “directed evolution irrespective of natural selection was their central point” (p.49).

By the mid-20th century “many authors [had] declared their support of orthogenesis. Some of their arguments seem convincing” (p.70). At the same time, the modern Darwinist stance (also known as the “modern synthesis”) was gradually developing, albeit with strong opposition from proponents of directed evolution. In France in particular, the Lamarckian heritage was still strong, with authors such as Pierre-Paul Grassé, Devillers and Chaline who “reject the *mystical* orthogenesis but admit the existence of constraints on variation and their significance in evolution; they pay a tribute to the modern synthesis but point out the need for a new one” (p.77). In fact, while modern Darwinism has its convincing thesis of the role of natural selection, it cannot really explain orthogenetic evidence; “several theorists of the modern Darwinism simply never mentioned orthogenesis though they were evidently familiar with it” (p.78). Popov shows that the idea of directed evolution is still present today, but with new arguments and in new words: “the idea of directed evolution repeated itself” (p.85). The obvious success of modern Darwinism has not put an end to the controversy. The situation is particularly interesting in Russia “because in the Soviet Russia Darwinism occupied the same place in biology as communism did in society. Orthogenesis was in contrast with official ideology” (p.101); “yet orthogenetic heresy surfaced in the Soviet Union with a persistence that seems to indicate the solidity of its argumentation base” (p.101).

Popov cites the example of the ageing of species as a case that cannot be convincingly explained by modern Darwinian stances: “it is evident that numerous extinctions over millions of years cannot be explained convincingly in terms of the natural selection theory.” (p.135). It is very difficult to explain the relevance of individual ageing to natural selection, although certain organs may be “useless for an organism but creating preconditions for the origin of ‘useful’ organs in its distant descendants [...] they do not disappear in the immediate descendants but continue to evolve although their adaptive significance does not become apparent for a long time” (p.151). The variability of nature is much weaker than might be expected according to “the prevailing Darwinian view about an unlimited variability” (p.173); for example, the fact that there are no viviparous birds would suggest the persistence of a predetermined anatomical plan applying to the entire group. These are just some of the (many) objections reported by Igor Popov and presented by proponents of orthogenetic stances opposed to modern Darwinian views, with arguments including “constraints on variation, purely age-related changes in the evolution of groups of organisms, preadaptations, parallelisms and convergences, maladaptive characters [...]. Advocates of directed evolution paid special attention to these phenomena and collected abundant material on them” (p.201).

“Orthogenesis has often been accused of ‘mystics’, ‘vitalism’, ‘teleology’ etc. but these accusations were little more than insults” (p.187). For Popov, the main

reason for orthogenesis still being unpopular is that “it places unsolved issues at the centre of the evolutionary concept” (p.187). Yet modern Darwinian synthesis cannot explain a number of observed facts.

But do Darwinism and orthogenesis have to be mutually exclusive? Surely an orthogenetic point of view can be compatible with natural selection. Allow me to cite an example from my own research. I am a firm believer in modern Darwinism, but have also argued for a moderately orthogenetic thesis, and have shown, in parallel to what is clearly natural selection, that the complexity of living beings can be explained by a construction in “mosaic formation” produced by the repeated application of two basic principles: *juxtaposition* of similar units and the subsequent *integration* of these units into more complex structures⁴. From a philosophical point of view, the evolution of living systems towards complexity can be considered (as is the case of a number of other biological arguments⁵) to be a form of Aristotelian entelechy⁶, combining the complete achievement of a whole (*holos*) and of an ultimate purpose (*telos*), the purpose being the goal of the internal construction of living organisms. This hypothesis of a “goal by internal construction” is important as it does not rely on external, vitalist principles. The mosaic approach leads to broader orthogenesis with living organisms developing greater complexity. While the mechanical principle of natural selection is blind and never final, it can be reconciled with the parallel occurrence of other processes, such as constructions in mosaic formation leading to the apparent linearity observed in certain groups of living beings and to a certain internal *telos*. Orthogenesis, seen here as entelechy, may thus be considered to be compatible with and complementary to Darwinian selection.

Igor Popov’s book presents thought-provoking arguments in a key field of biology, an excellent analytical account of the historical developments of ideas, and prospects for new stances in the theory of evolution. A new synthesis of evolutionary processes is clearly needed and will no doubt reach a general level of compatibility between Darwin’s natural selection and orthogenetic arguments. As Igor Popov concludes, “orthogenesis is a productive, though unrealised trend rather than a dead-end of the evolutionary thought” (p.201).

⁴ G. Chapouthier, *The Mosaic Theory of Natural Complexity – A scientific and philosophical approach*, Editions des maisons des sciences de l’homme associées, Collection interdisciplinaire EMSHA, La Plaine-Saint-Denis, France, 2018, ISBN: 9782821895744, <http://books.openedition.org/emsha/200>.

⁵ W. E. Ritter, Why Aristotle invented the word Entelecheia, *The Quarterly Review of Biology*, 1932, 7(4), pp 377-404.

⁶ G. Chapouthier, Aristotelian entelechy and modern biology, *Biocosmology – Neo-Aristotelism*, online, 2018, 8_(3-4), pp 421-429

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 Springer