The Importance of B. M. Kozo-Polyansky's Work for Modern Science

The acknowledgment of Darwin's principle of natural selection as one cause of adaptive evolution is especially important in the history of evolutionary thought. However, the explanation of evolutionary phenomena requires additional principles, one of which is Kozo-Polyansky's symbiogenesis.

The concept of symbiogenesis is one of the most fundamental explanatory factors of evolutionary change. Kozo-Polyansky recognized that complexity in individuals occurs not only through differentiation in single beings but also through the union of organisms; in symbioses, interdependence increases. The symbiosis process may even lead to the emergence of a complex life-form that displays all morphological and physiological qualities of its components in a new entity. Kozo-Polyansky, using the term coined by Merezhkovsky (1909), named this evolutionary principle "symbiogenesis."

Boris Mikhaylovich Kozo-Polyansky (20 January 1890–21 April 1957), an outstanding evolutionary biologist and a prominent specialist in the morphology and phylogeny of plants, published a number of pioneering works. His expertise led him to new general theoretical works on various aspects of evolution. In spite of its breadth, Kozo-Polyansky's work (Kozo-Polyansky, 1923, 1925, etc.) was always directed toward the expansion of classical Darwinism.*

*See K. M. Zavadsky, *Razvitie evolyutsionnoj teorii posle Darvina (1859–1920-e gody)* [The Development of Evolutionary Theory after Darwin, 1859 to the 1920s] (Leningrad: Nauka, 1973); A. B. Georgievsky and L. N. Khakhina, *Razvitie evolyutsionnoj teorii v Rossii* [The Development of Evolutionary Theory in Russia] (St. Petersburg: Feniks, 1996).

Kozo-Polyansky first stated his symbiogenesis idea at the All-Russian Congress of Botanists (1921) in the context of plant phylogeny and systematics. In his book, *New Principle of Biology: The Essay on the Theory of Symbiogenesis* (1924), Kozo-Polyansky presented a complete picture of his views on the role of symbiogenesis in evolution.

This principle had three major components. First, he defined and outlined the basic ideas. Second, he defended these ideas with information extracted from published literature. Third, he connected symbiogenesis to Darwin's principle of natural selection. Here we see Kozo-Polyansky's innovative spirit and the unmistakable passion for novelty that characterizes all of his work.

Kozo-Polyansky defined symbiosis as an important strategy for the survival of living organisms; he discussed the degree of integration of the symbiotic components. He saw that through integration subjected to natural selection, adaptive value could dramatically increase. He suggested that the highest degree of integration of symbionts leads to the emergence of united systems (consortia). Thus, the reality of symbiogenesis was embodied in the phylogenetic history of consortia.

Kozo-Polyansky, who knew several European languages and was well versed in many areas of biology, collected an overwhelming amount of information about consortia, symbio-organs, symbio-tissues, and other traits of symbiotic origin in many plants and animals. He marshalled facts to "inevitably and decidedly" witness the role of symbiogenesis in evolution.

Symbiogenesis as a factor in evolution is a "specific new principle of biology" rather than a "general biological law." It was the combination of Kozo-Polyansky's symbiogenesis and Darwin's natural selection that explained many evolutionary phenomena; a primary one is the origin of eukaryotes, a major branch of life.

Thus, B. M. Kozo-Polyansky refuted the view that symbiogenesis is a "fantasy," a "nonscientific" concept. When he placed it among well-documented scientific theories, he predetermined its significance for modern science.

This publication of Kozo-Polyansky's book in English, the best possible monument to its author, signals recognition of the importance of his symbiogenesis principle.

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