Symbiogenesis: A New Principle of Evolution

Boris Mikhaylovich Kozo-Polyansky
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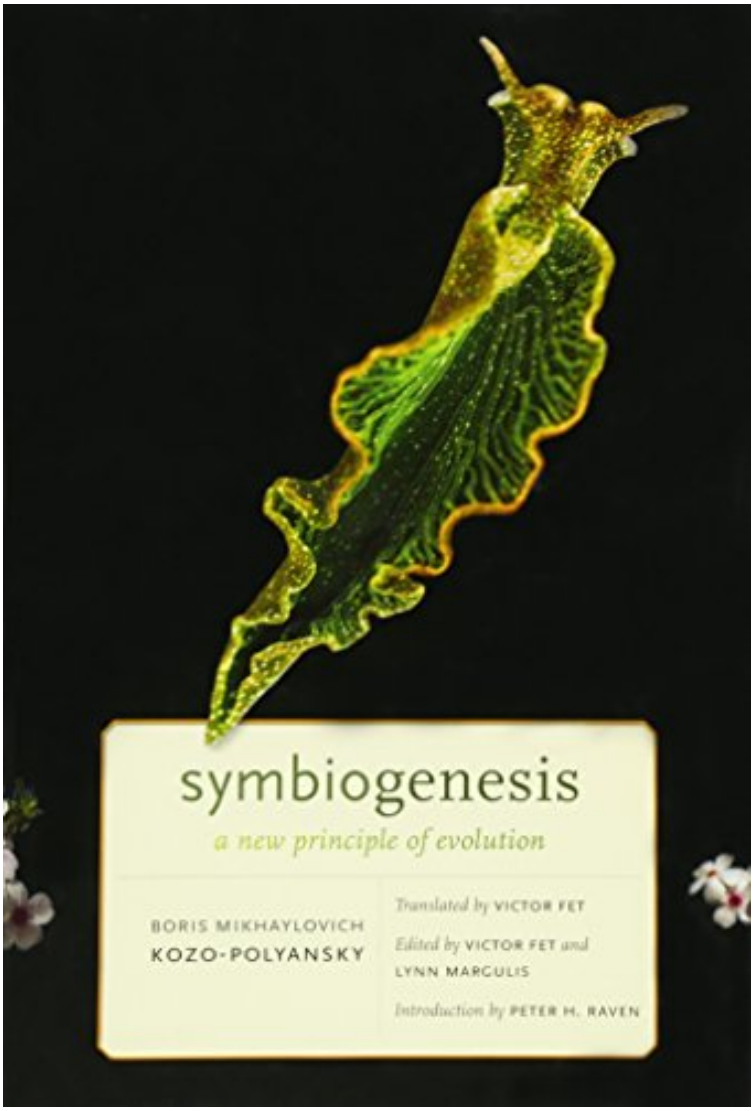

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Boris Mikhaylovich Kozo-Polyansky : Symbiogenesis: A New Principle of Evolution before purchasing it in order to gage whether or not it would be worth my time, and all praised Symbiogenesis: A New Principle of Evolution:

2 of 2 people found the following review helpful. A book on the history of scienceBy Ernesto Alvarado ReyesThis book is an ancient review on microbial symbioses, endosymbiosis and plant grafting. It was written by a Russian botanist and edited by the well known theorist and polemicist Lynn Margulis. The first part of the book has examples on bacterial consortia and speculates how the eukaryotic cells were formed by consortia of bacteria and archaea. Kozo-polyansky then continues stating the well known theory of endosymbiosis as postulated by Merezhkovski. That is that

plastids in eukaryotes originated from symbiotic cyanobacteria. He then postulates the theory of Portier that states that mitochondria were once symbiotic proteobacteria. Lynn Margulis makes clear in her footnotes that both theories have been shown right with modern genomics. Then Kozo-polyansky keeps speculating on how the rest of the cell organelles and structures are also endosymbiotic in nature. This interesting hypothesis has not been tested by modern science. Unfortunately, as Lynn agrees with Kozo-polyansky on this belief, she does not state when a statement has not yet been tested, so if readers do not have a good knowledge of cell biology they might think all the ideas of Kozo-polyansky have been verified by modern science.In the second part Kozo-polyansky shows examples of symbioses between several types of organisms. He includes examples of marine animals with bioluminiscent bacteria, lichens, nostocales in bryophytes and ferns, bacteriomes of arthropods, worms and sponges with endosymbiotic algae, and dinoflagellates and algae that live inside basal eukaryotes. An interesting part of this chapter of the book are his statements on plant grafting. I learnt quite a long time ago that there were chimeric mice. However, I always thought such term originated when cells from the inner cell mass of an embryo were introduced to the inner cell mass of another embryo thus forming a chimeric mouse. Kozo-polyansky shows that the term originated in the 19th century and that originally, a chimera was a plant that had cells from different parental species. These plants were not hybrids, but the result of graftings from different species that resulted in mosaic plants with some cells of one species and others from a different one! This was quite new to me, so I enjoyed the part on plant grafting. A good thing that Lynn did in this chapter was to include a photograph of Midichloria mitochondrii living inside the mitochondria of its eukaryotic host, a tick. Any fans of Star Wars will quickly recognize that the name of the genus of this bacterium is based in the midi-chlorians from Episode I! Although I am not particularly fond of such explanation of the Force, I still loved to see that Lynn included an indirect reference to Star Wars!The third part of the book is a philosophical discussion on symbioses in nature. Some of the insights of Kozo-polyansky are quite amazing. He says that Darwin was wrong by stating that organisms realte to each other in a "tree of life". Kozo-polyansky says that organisms rather relate to each other in a "net of life". This idea is quite ahead of its time. Even today, biologists that only work with eukaryotes still prefer to use the term of tree of life rather than net of life. Genomicists working with prokaryotes know that Kozo-polyansky was quite right due to the horizontal transfer of genes. Kozo-polyansky tries to be politically correct, in order to keep his Soviet overlords happy with him. We should remember that during the rule of Stalin many biologists who went against the ideas of Lysenko were severely punished. Hence, Kozo-polyansky includes ideas from communist rhetoric in his philosophical account on symbioses. I do not know if he truly believed in them or if he did that to conform to his society ideas.Finally, in the last part he credits Empedocles, the ancient philosopher from Sicily; and Darwin as the discoverers of endosymbiosis theory. While I agree with Kozo-polyansky that Empedocles was a great alchemist and that Darwin was the most important thinker in biology, I do not think they formulated endosymbiosis theory. In order to conclude this, Kozo-polyansky tries to read between lines to show that Empedocles and Darwin believed exactly what he was showing in his book. He uses the kind of hermeneutics used by Anaxagoras of Clazomenae, Theophrastus and Philo of Alexandria to do this. In our own days we are familiar with this type of hermeneutics, as they are used by Christians and Jews to study the Bible and by Muslims to study the Quran. I do not think we should study the works of Darwin using these type of tools, but Kozo-polyansky is quite happy using them.Lynn Margulis published this book to show how Russians invented and developed endosymbiotic theory before molecular biology. This book indeed credits Merezhkovski with this theory (if we do not read the works of Empedocles and Darwin as if they were the Bible) and shows a time when this theory was not as fully accepted as it is today.1 of 1 people found the following review helpful. "If you need a new idea, read an old book."By Perry MarshallThis is a huge missing piece in the evolutionary toolbox. Symbiogenesis is a major component of empirical evolution and partly explains the phenomenon of Punctuated Equilibrium - nature makes jumps, does not merely proceed gradually.The authors resurrected this from early 20th century Russia and it proves the adage "If you need a new idea, read an old book."Update for those interested in this subject: Dr. Kwang Jeon, a professor at the University of Tennessee, did an experiment where tens of thousands of bacteria took up residence inside Amoeba proteus organisms. A fierce parasitic attack ensued, killing almost all the amoeba. But in the space of a year, amoeba and bacteria entered into symbiosis. Both modified expression of their genes as necessary, to support the mutual dependence.Jeon learned how to reliably trigger symbiotic cell mergers between amoeba and bacteria. It took 200 generations, about 18 months, for the cells to become fully interdependent. After that, removal of either sym- biotic partner proved fatal to both.Jeon, rather than merely theorizing or fighting about evolution, proved it in the lab in real time. Symbiogenesis experiments such as these are moving evolution from having been mostly based on anecdotal evidence, to an empirical discipline where we discover how to generate new species at will. People like these are the real heroes of evolution.I had the privilege of corresponding with Dr. Victor Fet, the translator, and he was thankful for the privilege of working with Lynn Margulis to bring this book to fruition.

More than eighty years ago, before we knew much about the structure of cells, Russian botanist Boris Kozo-Polyansky brilliantly outlined the concept of symbiogenesis, the symbiotic origin of cells with nuclei. It was a half-century later, only when experimental approaches that Kozo-Polyansky lacked were applied to his hypotheses, that scientists began

to accept his view that symbiogenesis could be united with Darwin's concept of natural selection to explain the evolution of life. After decades of neglect, ridicule, and intellectual abuse, Kozo-Polyansky's ideas are now endorsed by virtually all biologists.Kozo-Polyansky's seminal work is presented here for the first time in an outstanding annotated translation, updated with commentaries, references, and modern micrographs of symbiotic phenomena.

The differences between prokaryotes and eukaryotes are much more deep and fundamental than, for example, those between higher animals and higher plants. Numerous facts, especially those from cytology of simplest eukaryotic organisms, support the views of Kozo-PolyanskyMargulis. The eukaryotic cell, compared to a prokaryotic cell, is already rather some sort of "supercell." A specific "assembly" of a complex eukaryotic system from already largely "prefabricated parts" took place during the process of evolution. (Armen Takhtajan, Komarov Botanical Institute, Russian Academy of Sciences)How could this book not have been a part of evolutionary biology since its publication in 1924? What a difference it would have in the "evolutionary synthesis" if this book were easily in the hands of biologists in German or English translation! (William Provine, Cornell University)Aiming to acquaint readers with the history of symbiogenesis theory, this excellent book accomplishes more than a mere presentation of a translated work originally written in the 1920s. Margulis and Fet have brought forth a gem of evolutionary thinking, essentially lost because it was published in Russian, which shows how the development of modern symbiogenesis theory (particularly that of Margulis) was anticipated (and would have been greatly aided) by the late botanist Kozo-Polyansky's work. It is a commendable piece of scholarship to present a publication that, in many ways, "scoops" the authors' own contributions to the field, if only in retrospect. Fet and Margulis, however, not only revive the book, they bring it fully into the sweep of modern theory by clearly and succinctly translating the original terms into their modern equivalents and correcting for the reader the statements by Kozo-Polyansky that have not held up over the intervening 85-plus years. Their insertions into the text are clearly marked and succinct, and do not detract from the original. Indeed, the book is as much a summary of the way science self-corrects and refines itself as it is a presentation of Kozo-Polyansky's work. (S. J. Oliver Choice 2011-10-01)About the AuthorBoris Mikhaylovich Kozo-Polyansky (18901957) graduated from Moscow University and in 1918 joined a Soviet university in his native Voronezh where he became a vice-president as well as director of the local botanical garden.Victor Fet is Professor of Biology at Marshall University, Huntington, West Virginia.Lynn Margulis was Distinguished University Professor in the Department of Geosciences at the University of MassachusettsAmherst.Peter H. Raven is President of the Missouri Botanical Garden.