

## Konstantin Sergeyevitch Merezhkovsky (1855–1921) – the protistologist who discovered the origin of eukaryotic cells

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### Summary

This article presents a life story of Prof. K.S. Merezhkovsky and his contribution to protistology and evolution theory. Despite the conventional point of view, he cannot be treated as a pure botanist, but rather as protistologist, zoologist, and even a successful anthropologist and science fiction writer.

**Key words:** life story, K.S. Merezhkovsky, protists, theory of symbiogenesis

January 9, 2021 marked a centenary since the date of death of the well-known Russian protistologist, zoologist, botanist, and anthropologist K.S. Merezhkovsky (1855–1921)<sup>1</sup>. As early as in 1905, Konstantin Sergeyevitch postulated that plastids originated from blue-green algae (cyanobacteria). This finding ranked Merezhkovsky among the founders of the symbiogenetic theory of eukaryotic cell origin (Khahina, 1979; Höxtermann, 1998; Voronzov, 1999; Sumeiko, 2001; Kutschera and Niklas, 2005; Fokin, 2005, 2008). Having systematized his extensive observations on the diatoms from all over the world, Merezhkovsky came to the conclusion about the autonomous nature of chromatophores (chloroplasts = plastids). Thus, he established a novel view on evolution, the theory of sym-

biogenesis (Merezhkovsky, 1910), according to which the plant cell was the result of symbiosis of an animal cell and a chloroplast, initially a free-living organism. At that time, the idea elicited almost no response, neither in Russia nor abroad. Nevertheless, just a few years after the first publication by Merezhkovsky, his professor at St. Petersburg University, academician A.S. Faminzin (1847–1918), accepted this idea (Famintzin, 1907). Gradually, a number of scientists rediscovered and then supported this idea, and many years later the theory was revived and further developed by Lynn Margulis in her books “*Origin of Eukaryotic Cells*” (1970) and “*Symbiosis in Cell Evolution*” (1993), as well as by dozens of authors in more recent publications.

My focus here is to shed more light on the man who opened this fruitful field – Prof. Merezhkovsky. Currently, most publications refer to him as a botanist (Voronzov, 1999; Kutschera and Niklas,

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<sup>1</sup> Spelling of the surname varies significantly: Mereschkovsky, Merezhkovskij, Merezhkovskiy. The Russian original is Мережковский.



Fig. 1. K.S. Merezhkovsky. St. Petersburg, 1884 (the author's collection).

2005). However, in fact, he was a broader specialist – a protistologist, since diatoms, which were the main object of his research and led him to development of the now widely recognized theory of symbiogenesis, are classical protists.

K.S. Merezhkovsky started his scientific career as a zoologist. Moreover, he was one of the first who began to study protists in the North of Russia, around the White Sea (Fokin, 2008). Representatives of ciliates and heliozoans, which are shown in the figure at the front cover of the current volume of the *Protistology* journal, were originally published in his large study of protistan biodiversity (Merezhkovsky, 1878).

So, who was this man? Konstantin Merezhkovsky was born on 23 July 1855 in St. Petersburg (according to old Russian calendar). His father, Sergei I. Merezhkovsky, was a nobleman, the head of the Court Office and the Privy Councilor. Among the nine children of Sergei I. Merezhkovsky, the best known is Dmitriy (1865–1941), a writer, poet, and Konstantin's younger brother.

In 1874, Konstantin S. Merezhkovsky graduated from the Imperial School of Law. The choice of the educational establishment must have been made by his father, since Konstantin himself showed no interest in jurisprudence and spent all his free time reading natural history books in Russian and the main European languages. In the following year, he entered St. Petersburg University and completed the course at the Zootomical Cabinet of Prof. N.P. Wagner with the candidate's degree (1880)<sup>2</sup>. During his university studies, Konstantin Merezhkovsky made two journeys to the White Sea (1876, 1877), a journey to the Naples Zoological Station (1879), and one to Crimea (1880). His Russian journeys resulted in a number of articles on protozoans, coelenterates, and sponges of the White Sea, the ciliates of the Black Sea, and the anthropology of Stone Age people in Crimea (Formozov, 2004).

Merezhkovsky's student work on sponges was awarded the Kessler Prize in memory of the First Congress of Russian Natural Scientists. His investigations in Naples involved protists and coelenterates, and the results were published in French and Russian. At the University, along with his studies, Merezhkovsky was also the conservator at the Zootomical Cabinet. In 1880–1882, the scientist was sent abroad by the Russian Ministry of People's Education. During this trip, he conducted zoological investigations in Leipzig under the supervision of Rudolf Leuckart, worked in the field of anthropology in Berlin with Rudolf Virchow (1821–1902), and in Paris with Henri de Lacaze-Duthiers (1821–1901).

In the spring of 1881, Merezhkovsky paid a brief visit to St. Petersburg. This was the time when the Tsar Alexander the Second was killed by the terrorists. Attitude toward this event was the reason for the discord between Konstantin and his father. Then he returned to Naples, worked there for the next nine months (until November 23, 1881) and spent the winter in Paris studying anthropology.

During this visit to Naples, Merezhkovsky investigated ciliates, coelenterates, and crustaceans. He also studied animal pigments. Altogether, he published 12 articles on the materials obtained in Naples. On returning to St. Petersburg at the end of 1883, he was given a docentship for the study done in Naples, "*Materials for the Understanding*

<sup>2</sup> In fact, K.S. Merezhkovsky was the only true student-follower of Prof. Wagner.

of *Animal Pigment*". As a Privatdocent, he lectured on invertebrate zoology and entomology at the University and the Higher Women's Courses. Merezhkovsky wrote to Anton Dohrn in Naples that his immediate aim was the foundation of an anthropological society<sup>3</sup> in St. Petersburg, also expressing his doubts about the feasibility of getting the necessary permission, since at those times any initiative, however innocent, elicited the suspicions of the authorities and was suppressed. At the end of 1884, Merezhkovsky was confirmed as a conservator at the Zootomical Cabinet. In the summer of 1885, he was relieved of both the conservator's position and the privatdocentship but remained at the University for a one-year training for a professorship with a scholarship.

In the autumn of 1886, Merezhkovsky left the University due to complicated family circumstances and the decline of his health. He stayed away from science for several years and lived in Crimea and the Caucasus. Having finally settled at the southern shore of Crimea in 1888, he became the director of the Crimean Orchards of the Imperial Court in 1891–1893. Here, Merezhkovsky became interested in the study of horticulture, especially of grapes. With this in view, he made a journey abroad in the autumn of 1891 and studied the vineyards of the southern Crimea. In the same year, the Imperial Court commissioned Merezhkovsky to compile "*The Crimean Ampelography*", for which he was collecting materials until 1893. When the scientific description of the Crimean grape varieties had already been sent to the publisher, the work was suspended because of conflicts with the commissioner and the manuscript was given to S.I. Korzhinsky (1861–1900) to complete. The latter revised the text but "*Ampelography*" was not published until after his death, in 1901.

The circumstances of Merezhkovsky's life in 1894–1901 are obscure. According to his letters to A.S. Famintzin, sent from the USA in 1901<sup>4</sup>, he continued scientific research privately. He prepared four articles on diatoms based on the materials collected in 1894–1897 at the Black Sea and in the Mediterranean (Villefranche). He also continued to study diatoms in California, at a new biological station of the University of California (Berkeley) in

San-Pedro, near San Diego. Apparently, at that time Merezhkovsky had a "secret life" and was living in the USA under the name of William Adler. Later on, it became clear that this strange behavior was accounted for his nontraditional sexual orientation.

In April of 1898, Merezhkovsky wrote to Anton Dohrn about his depressed state of mind. He asked Dohrn for any modest position and assured him that he had not dropped his scientific studies. However, there were no options in Naples.

At the end of 1902, Merezhkovsky returned to scientific activity as a staff warden of the Zoological Cabinet at Kazan University, whereto he was invited by A.A. Ostroumov (1858–1925). At that time, he was studying the morphology of diatoms, thus finally leaving zoology. As a logical completion of this process, he transferred to the Department of Botany at Kazan University in 1904.

At the end of 1903 in Kazan, Merezhkovsky defended the Magister's Thesis (PhD), "*On the Morphology of Diatom Algae*", and was appointed Privatdocent at the Department of Botany. In 1906, he was appointed extraordinary professor at this Department. In the same year, he defended the Dr. Sc. thesis, "*Laws of Endochrome*", at Moscow University. Since early 1908, as a result of a prolonged correspondence with the Ministry of People's Education, Merezhkovsky got the position of extraordinary professor and soon – of ordinary professor.

In Kazan, Merezhkovsky lectured on the systematics of plants and published a book entitled "*A Theory of Two Plasms as the Basis of Symbiogenesis, a New Theory of the Origin of Organisms*" (1910). In this study, Merezhkovsky developed his novel view on evolution, the theory of symbiogenesis. Merezhkovsky showed no interest in teaching, giving all his energy to science and political activity at the University, where he was one of the leaders of the right-wing group of professors. During 1908–1909, he undertook several trips abroad and in Russia, continuing his studies of symbiogenesis on lichens. At the same time, he also published two textbooks: "*A Concise Course on Spore-Forming Plants*" and "*A Concise Course on General Botany*" (1909–1910).

The Kazan period of Merezhkovsky's life ended suddenly. In the spring of 1914, he was dismissed from the position of ordinary professor of Kazan University due to the transfer of the latter under

<sup>3</sup> He made a private anthropological expedition to Crimea in summer 1879 and found there a number of artifacts belonging to Stone Age people. Merezhkovsky should be treated as a pioneer of this field (Formozov, 2004).

<sup>4</sup> St. Petersburg branch of the Archive of Russian Academy of Sciences. Fond 39. Inventory 2. File 18. P. 1-2.

# „ЛЮБИТЕЛЬ ПРИРОДЫ“

ОРГАНЪ ОБЩЕСТВА ЛЮБИТЕЛЕЙ ПРИРОДЫ,

ИЗДАВАЕМЫЙ ВЪ С.-ПЕТЕРБУРГѢ

ПОДЪ РЕДАКЦІЕЙ И. И. МАМОНТОВА.

№ 8—9.

Августъ—Сентябрь 1910.

Годъ V.

Два рода плазмы и роль ихъ въ образованіи органическаго міра.

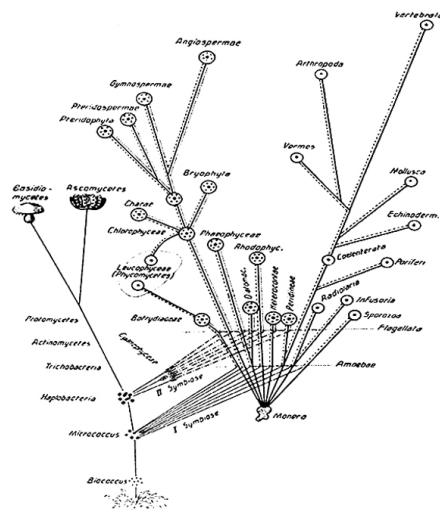


Fig. 2. «Lover of Nature» Journal of the Society of Nature Lovers, St. Petersburg, 1910, No 8–9. The first popular presentation of the theory of two plasmas made by K.S. Merezhkovsky in the article entitled «Two types of plasma and their role in the formation of the organic world». The Merezhkovsky’s figure-diagram of evolution.

the administration of the Ministry of People’s Education. This strange explanation was chosen because Merezhkovsky was in fact charged with debauchery of youth. While his case was under investigation, it turned out, among other things, that in 1903 he had published a book in Germany entitled *Das irdische Paradies*, which was atheistic and in part antigovernmental (Sapp et al., 2002).

Facing a criminal trial, Merezhkovsky left Russia for France, where he became part of an exile community. Information about the criminal case soon leaked to the press (“Marquis de Sade from Kazan”), so he left France for Switzerland (Geneva) in 1918. Staying at a hotel, he continued to work. His last scientific article, “*The Plant Considered as a Symbiotic Complex*”, was published in Geneva in 1920. On 9 January 1921, when Merezhkovsky’s savings were exhausted, he committed a suicide in the hotel room

by means of a narcotic mixture. “Too poor to live, too old to work” was the explanation he made in his last note.

The complicated life story of Merezhkovsky, his emigration from Russia and the tragic end were the reasons why his main scientific achievements remained forgotten in Russia for a long time. However, the international enthusiasm for symbiogenesis in the last 40 years has once again rescued Prof. Merezhkovsky from oblivion.

There exists a recollection about K.S. Merezhkovsky during the St. Petersburg period made by one of his students, A.M. Nikolsky, a zoologist (later an academician in Ukraine): “He was a talented man, a promising scientist. With a pale, handsome, intelligent face and burning eyes, he used to be very attractive for audiences”. In fact, during 1884–1886, K.S. Merezhkovsky covered a majority of professorial duties of N.P. Wagner, who was not as active anymore as a head of Zootomical Cabinet. As a teacher, for instance, Merezhkovsky was the first who organized the practical course for students in invertebrate zoology (1884).

Among Merezhkovsky’s literary heritage scattered in the Russian, German, English and French periodicals and devoted to zoology, botany, gardening, anthropology, philosophy and the internal life of Kazan University, a special place is occupied by his utopian novel *Das irdische Paradies* about the people of the 27<sup>th</sup> century, published in Berlin in 1903, in Russian (*Рай Земной – Ray Zemnoy*) and in German languages. This utopian novel could, in some respect, be considered the basis of Russian science-fiction literature. However, it is not only literature; it is a document of a personal drama and an expression of the *Zeitgeist* (Spirit of the age). Today, K.S. Merezhkovsky is generally remembered as a botanist who made an important contribution to a currently popular theory. However, it should be noted that his zoological articles are also of high value. He was one of the first Russian protistologists and specialists in lower metazoan groups. In fact, he proposed the first definitions of prokaryotic and eukaryotic levels of cell organization. To some extent, Merezhkovsky’s teaching at St. Petersburg University helped several then well-known researchers like V.A. Fausek (1861–1910), J.N. Wagner (1865–1946), N.M. Knipovich (1862–1939) as well as some others on their way to science. Among them was J.I. Andrusova (1863–1942) – one of the first Russian female protistologists. However, it was not the case of the famous protistologist W.T.



**Fig. 3.** *Wagnerella borealis* – a heliozoan protist described by K.S. Merezkhovskij (1878) from the White Sea and named after his teacher, N.P. Wagner. On the carapace of mysid. The White Sea (photo by M. Feduk).

Schewiakoff, who was a student at St. Petersburg University at that time, even though such a viewpoint can still be found in the Internet.

The diverse talents of the scientist, alas, did not make him famous during his lifetime. Now, 100 years after his death, the name of Konstantin Sergejevitch Merezkhovskij in science is not less known than the name of his brother Dmitry Sergejevitch Merezkhovskij in Russian literature.

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