

Special issue on evolution and biogenesis of chloroplasts and mitochondria

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Mitochondria and chloroplasts are both of endosymbiotic origin. In an initial step about 1.5–2.0 billion years ago an α -proteobacterium was taken up into an undisclosed host cell and enslaved to become mitochondrion. Later a mitochondria containing cell took up an ancestral photosynthetic cyanobacterium, which became a chloroplast. Both primary endosymbiotic events occurred successfully only once in evolution. During the endosymbiotic process, massive gene transfer to the host nucleus and gene loss occurred. The arising eukaryotic cell took the chance from combining three genomes to establish a division of labour principle in the newly compartmentalised cell. Though mitochondria and chloroplasts have retained a remnant genome and the capacity for transcription and translation, the control lies with the nucleus. Organellar genomes have been retained throughout all eukaryotic life forms with very few exceptions. The reasons for this are not completely understood.

Anabolic and catabolic biosynthetic pathways are in many cases distributed between different cellular

compartments and endosymbiotic organelles forming an integrated highly sophisticated network. For example, the process of photorespiration involves chloroplasts, mitochondria, peroxisomes and the cytoplasm, thus requiring multiple membrane transporters and metabolic crosstalk to coordinate the process.

In October 2012 an international symposium at the University of Munich in Germany entitled “Endosymbiosis: From Prokaryotes to Eukaryotic Organelles” highlighted many of the fundamental aspects surrounding the endosymbiotic process as well as mitochondrial and plastid function. Many colleagues who attended the conference contributed to this special volume in “Planta” on “Biogenesis and Function of Chloroplasts and Mitochondria”. It provides a number of fascinating peer-reviewed articles on how these organelles perform today, how their interplay works and what challenges we face in the future. I like to thank everybody involved in making this special volume possible.

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