

## The nature of the mitochondrial ancestor

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Mitochondria allowed the ancestor of all eukaryotes to become efficient aerobic respirers. The very ancestral nature of mitochondria, however, remains unknown. One intriguing hypothesis is that mitochondria evolved from early alphaproteobacterial photosynthesizers that compartmentalized their bioenergetic metabolism into intracytoplasmic membranes (ICMs). I first discuss recent experimental evidence for the idea that mitochondrial cristae evolved from ICMs. This implies that the pre-mitochondrion was pre-adapted to become an efficient bioenergetic organelle. I then move to discuss a new consensus phylogeny for the Alphaproteobacteria. This new view shows that the Rickettsiales are polyphyletic and therefore weakens recent proposals for a rickettsial origin of mitochondria. Moreover, I present a great diversity of novel 'environmental' alphaproteobacterial genomes reconstructed from halophilic microbial mats, alkaline microbialites, aquifers and worldwide oceans. With this new diversity at hand I have attempted to place the mitochondrial lineage among alphaproteobacteria using the largest dataset suitable for this task yet built. Finally, I end by discussing the nature of both the alphaproteobacterial ancestor and mitochondria.