

Evolution of organellar transcription machinery in bryophytes and vascular plants

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Plastids and mitochondria are both considered as descendants of eubacterial endosymbionts. The origin of plastids is thought to be an ancestor of extant cyanobacteria, while the origin of mitochondria is likely to be an ancestor of alpha proteobacteria. This inference is mainly supported by the comparison of genomic sequences of the organelles and various bacteria. However, we recently pointed out that, based on accumulating database information and analytical data of nucleoids, the replication and transcription systems of plastids (or plastid genomic machinery) might not be very similar to those of eubacteria¹. In this communication, we provide further evidence that the genomic machinery of plastids and mitochondria is distinct from that of eubacteria. Two different RNA polymerases (RNAP) are known in plastids of angiosperms. One is encoded by the plastid genome and similar to bacterial RNAP, whereas the other is encoded by the nuclear genome and similar to RNAP of phage T7.

We isolated two cDNAs for the phage-type RNAP (PpRpoT1 and 2) in *Physcomitrella patens*². The protein products of these cDNAs, in the form of fusions with green fluorescent protein (GFP), were both targeted to mitochondria but not to chloroplasts. The transcription activity of isolated chloroplasts was nearly completely inhibited by tagetitoxin, an inhibitor of chloroplast-encoded prokaryotic RNAP. Phylogenetic analysis by the maximum likelihood and neighbour-joining methods clearly indicated that PpRpoT1 and PpRpoT2 form a sister group to the angiosperm RpoT proteins including both chloroplast and mitochondrial isozymes. Results of further analysis indicate that the duplication of RpoT gene leading to the generation of plastid isozyme occurred after the separation of angiosperms. Bryophytes and green algae are, therefore, simple with respect to RNAP: phage-type RNAP in mitochondria and bacteria-type RNAP in chloroplasts. We will also present information concerning DNA polymerases and DNA-compacting proteins^{3,4} in the organellar nucleoids.

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