THYLAKOID MEMBRANES IN CHLOROPLASTS: BIOGENETIC COMPLEXITY WITH PHYLOGENETIC ROOTS

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The photosynthetic machinery of chloroplasts is of dual genetic origin. It is embedded in the compartmentalized genetic system of the plant cell that is regulated spatiotemporally and quantitatively in its entirety. Consequently, biogenesis, function, and modification of the thylakoid system are complex, requiring the co-ordinated and subtle expression of genes located in nucleus/cytosol and plastids. Using various strategies including plastid and nuclear transformation protocols (gene modification and disruption), and somatic or genetic organelle exchanges to construct interspecific plastid/nuclear cybrids for evaluation of compartmental co-evolution, molecular biology and PAM technologies, we have begun to study thylakoid biogenesis in some detail. For instance, work on knock-out or RNAi strains of the intriguing low mass subunits of photosystem II has uncovered that their loss interferes with distinct stages in the biogenesis of the supramolecular assembly, that subunit PsbZ functions as a linker between PSII and LHC antenna, PsbJ regulates the forward electron flow from QA to the plastoquinone pool, and PsbL prevents reduction of PSII by back electron flow from plastoquinol. Processes that ensure maintenance, repair and adaptation of thylakoids contribute with comparable quality and in different time scales to the regulation of the photosynthetic process as those generating it, often with different regulatory components. More than a dozen thylakoid-located protein kinases, auxiliary proteins and a substantial number of proteases involved in these processes have been detected. Supported by the Deutsche Forschungsgemeinschaft (SFB 184, SFB TR1).