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Sommario/riassunto

Photosystem II is a 700-kDa membrane-protein super-complex responsible for the light-driven splitting of water in oxygenic photosynthesis. The photosystem is comprised of two 350-kDa complexes each made of 20 different polypeptides and over 80 co-factors. While there have been major advances in understanding the mature structure of this photosystem many key protein factors involved in the assembly of the complex do not appear in the holoenzyme. The mechanism for assembling this super-complex is a very active area of research with newly discovered assembly factors and subcomplexes requiring characterization. Additionally the ability to split water is inseparable from light-induced photodamage that arises from radicals and reactive O2 species generated by Photosystem II chemistry. Consequently, to sustain water splitting, a “self repair” cycle has evolved whereby damaged protein is removed and replaced so as to extend the working life of the complex. Understanding how the biogenesis and repair processes are coordinated is among several important questions that remain to be answered. Other questions include: how and when are the inorganic cofactors inserted during the assembly and repair processes and how are the subcomplexes protected from photodamage during assembly? Evidence has also been obtained for Photosystem II biogenesis centers in cyanobacteria but do these also exist in plants? Do the molecular mechanisms associated with Photosystem II assembly shed fresh light on the assembly of other

major energy-transducing complexes such as Photosystem I or the cytochrome b6/f complex or indeed other respiratory complexes? The contributions to this Frontiers in Plant Science Research Topic are likely to reveal new details applicable to the assembly of a range of membrane-protein complexes, including aspects of self-assembly and solar energy conversion that may be applied to artificial photosynthetic systems. In addition, a deeper understanding of Photosystem II assembly — particularly in response to changing environmental conditions — will provide new knowledge underpinning photosynthetic yields which may contribute to improved food production and long-term food security.