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The role of manganese-stabilizing protein of photosystem II

Abstract

The appearance of oxygenic photosynthesis was a key event in the evolution of life on the Earth. All molecular oxygen in the atmosphere likely comes from a water-splitting reaction catalysed by the oxygen-evolving center of photosystem II. Photosystem II – a multisubunit protein-cofactor complex with a phylogenetically highly conserved structure – is embedded in the thylakoid membrane of chloroplasts and cyanobacteria. The mechanism of the photosynthetic water-splitting reaction, which occurs on the manganese cluster, has been widely investigated; however, it has not yet been fully understood. An essential role in the stabilization of the manganese cluster and in the facilitation of oxygen evolution is played by photosystem II extrinsic proteins that occur in thylakoid lumen. The most important among them is a manganese-stabilizing protein (MSP) that is present in all known oxyphototrophs. This protein is believed to have many functions: besides stabilizing the manganese cluster, it is also carbonic anhydrase activity, GTPase activity and regulation of the turnover of the D1 protein. The functions of the MSP are probably regulated through changes in its dynamic structure. The MSP is likely to take part in the regulation of photosynthesis under various external and internal conditions. This work reviews the current understanding of the structure and the functions of the MSP, and summarizes the differences between two MSP isoforms in some higher plants.