A Novel Chlorophyll-binding Mode of Water-soluble Chlorophyll Protein (WSCP)

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Chlorophyll (Chl), the most important pigment in photosynthesis, is known as a generator of oxygen radical under excess light. Since the oxygen radical is harmful on plant cellular component, plants need to quench it. In the photosynthetic apparatus, carotenoid quenches the overexcited Chl by xanthophyll cycle. However, it still remains to be seen that how plants prevent the Chl-mediated oxygen radical formation at the stage of Chl biosynthesis and Chl transport pathway.

The putative Chl carrier, water-soluble chlorophyll protein (WSCP), prevents Chl-mediated oxygen radical formation without carotenoid in an as yet unknown manner [1]. To elucidate this mechanism, we crystallized the WSCP from *Brassica oleracea* var. *acephala* (kale) [2] and solved the crystal structure by molecular replacement method. The model structure, Lepidium WSCP (PDB code: 1WYA), shares 41% identity of primary sequence. Kale WSCP possesses a homo-tetrameric structure consisting of 19 kDa subunits, and each monomer contains one Chl but no carotenoid, as in the case of Lepidium WSCP.

The remarkable structural feature is that all four Chls are packed in a hydrophobic core at the inter-subunit interface. Because the Chls are secluded from solvent, it is unlikely that the excitation energy of Chl transfers to oxygen and generates radical species.

[1] Schmidt K. *et al*., *Biochemistry*, 2003, **42**, 7427. [2] Horigome D., Satoh H., Uchida A., *Acta Cryst*., 2003, **D59**, 2283.

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