Structure and function of photosystem I complexes

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Photosystem (PS) I complexes in oxygenic photosynthesis play an important role; produce NADPH by photoreduction of $NADP^+$ and make ATP by cyclic or non-cyclic electron flow through PS I, both of which are needed to fix inorganic carbon to carbohydrates.

The structure of the complexes is very complex; in cyanobacterial PS I complexes, they are thought to have 11-12 subunit polypeptides, about 100 chlorophyll a molecules, two vitamin K1 molecules, and three Fe-S centers.
The PS I preparation was less-modified than those already reported due to very mild detergent treatments and smaller steps of purification. The type of PS I crystals was also a new one. The crystals have all the constituent polypeptides and about 100 chlorophyll a molecules, and all electron carriers considered to belong to PS I (a paper is in preparation). PS I crystals as well as their X-ray diffraction patterns (the maximum resolution so far reported in the literature is 4 Å) were already been reported, we believe that our PS I crystals have advantages as mentioned above and are worth to be studied further.

Native data sets of the PSI crystal were collected at BL41XU equipped with a Weissenberg camera and a large-formatted imaging plate (40 x 80 cm). The wavelength of an incident beam was 0.708 Å and a crystal-to-detector distance was 560 mm. The crystals were frozen in liquid nitrogen and kept cooled at 100 K during the data collection by Oxford Cryosystems.

The crystals diffracted over 8 Å resolution and 21 frames with a rotation angle of 3.0 (degree) for each frame were stored from a crystal. The crystal belongs to the hexagonal space group P63 with unit cell dimensions of a=225.6, c=151.8 Å and gamma=120 (degree). The combined set gave 4,754 reflections to 8 Å resolution in total, which were reduced to 3,048 unique reflections with an R merge of 5.4% and a completeness of 64.2%.