

■ Research Highlights

Atomic basis for understanding bacterial photosynthesis

The light-harvesting 1 (LH1)-reaction center (RC) is a pigment-membrane protein super-complex existing in purple photosynthetic bacteria and functions in light energy absorption and conversion. It is viewed as the “the purple heart of photosynthesis” due to its importance in photosynthesis.

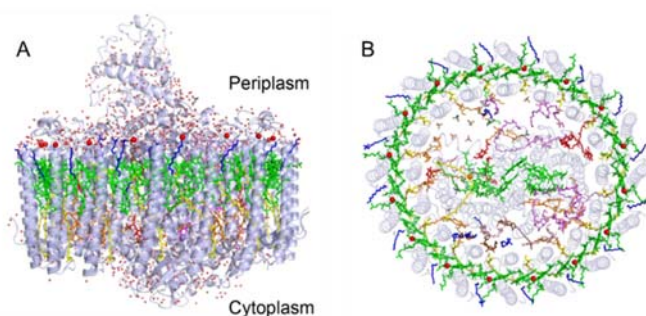
The structure of LH1-RC has been determined at a low resolution, but no high-resolution structure has been reported, which hampers our understanding of the mechanism of highly efficient light energy absorption and conversion within this super-complex.

Recently, Long-Jiang Yu and colleagues at Okayama University and Ibaraki University determined the high resolution crystal structure of LH1-RC from a thermophilic photosynthetic bacterium *Thermochromatium tepidum*.

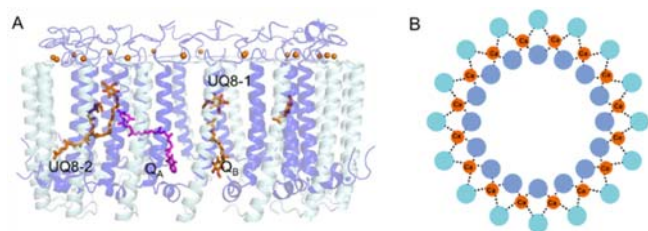
The resolution was significantly improved by optimizing methods for purification and crystallization, and the crystals obtained were used to collect X-ray diffraction data at the synchrotron radiation facility SPring-8.

The high resolution structure of LH1-RC revealed the detailed arrangement of the protein subunits and pigments within the super-complex, based on which, a number of novel and unique features were found. These include a completely closed ring structure of 16 pairs of LH1- α , β -subunits, possible quinone and proton channels, unique binding pattern of 16 Ca^{2+} ions related with the unusual red shift of the absorption peaks and thermostability.

The high resolution structure of LH1-RC provides a basis to elucidate the highly efficient light energy absorption and conversion reactions in bacterial photosynthesis, which may provide important clues for the development of artificial photosynthetic systems.



(Figure1) Side view (A) and top view (B) of the LH1-RC super-complex from *Tch. tepidum*. Colour codes: protein subunits, grey; BChls, green; spirilloxanthin, yellow; Ca^{2+} ions, red; water, raspberry.



(Figure2) (A) Distribution of the menaquinone and ubiquinone molecules over the LH1-RC super-complex. (B) Schematic model for the coordinating pattern of the 16 Ca²⁺ ions in the LH1 complex.

Reference:

- Author: Long-Jiang Yu, Michihiro Suga, Zheng-Yu Wang-Otomo and Jian-Ren Shen.
- Title of original paper: Structure of photosynthetic LH1-RC supercomplex at 1.9 Å resolution.
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