Phsiological role of two superoxide dismutases of *Rhodobacter sphaeroides* in performing photosynthesis

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Two different superoxide dismutases (SODs) are found in *Rhodobacter sphaeroides*, a purple nonsulfur bacterium performing anoxygenic photosynthesis; Fe-containing SOD (FeSOD) and Cu- and Zn-containing SOD (CuZnSOD). The *sodB* and *sodC* coding for the FeSOD and CuZnSOD, respectively, have been cloned and sequenced. The cytoplasmic enzyme, FeSOD, is expressed constitutively. However, the aerobic acitivity of the FeSOD is about two times as much as that of the photosynthetic activity, and its expression is controlled at the level of the *sodB* transcription. To the contrary, the periplasmic enzyme, CuZnSOD, is detected only with the photosynthetically grown cells, and its expression is regulated at the level of the *sodC* translation. Mutant strains having chromosomal knock-out of each *sod* gene were constructed in order to find out the physiological role of the SODs. Interestingly, FeSOD deficiency is responsible for an extensive lag phase of 70 to 80 h before resuming growth after culture transit from aerobic to anaerobic photosynthetic conditions, which strongly indicates that the FeSOD is essential for the *de novo* synthesis of the photosynthetic complexes. The *sodC*-deleted cell with no CuZnSOD showed no cultural differences distinguished from the wild type under both aerobic and photosynthetic conditions. However, sudden exposure of the photosynthetically grown *sodC*-deleted cells to 2% O_2 under light conditions showed more decrease in light-harvesting (LH) complexes, B800-850 and B875, compared with the wild type. Accordingly, the CuZnSOD seems to be responsible for the protection of the LH complexes from the oxidative damage by exposure to oxygen during the anoxygenic photosynthesis.