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# REDOX SIGNALING IN THE PHOTOSYNTHETIC BACTERIUM, *RHODOBACTER SPHAEROIDES*: THE $CBB_3$-PRRBA SIGNAL TRANSDUCTION PATHWAY

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The PrrBA two-component system in *Rhodobacter sphaeroides* 2.4.1, which is composed of the PrrB histidine kinase and the PrrA response regulator, controls the expression of most photosynthesis genes, either directly or indirectly, in response to changes in oxygen tension. In vivo under aerobic conditions it is the $cbb_3$ cytochrome *c* oxidase which generates an inhibitory signal shifting the equilibrium of the kinase/phosphatase activities of PrrB to the phosphatase mode. The extent of electron flow through the $cbb_3$ oxidase of *Rhodobacter sphaeroides* is inversely related to the expression levels of those photosynthesis genes which are under control of the PrrBA two-component activation system: the greater the electron flow, the stronger the inhibitory signal generated by the $cbb_3$ oxidase to repress photosynthesis gene expression. Using purified $cbb_3$ cytochrome *c* oxidase, PrrB, and PrrA, we demonstrate in vitro that the $cbb_3$ oxidase inhibits PrrB activity by apparently increasing the intrinsic PrrB phosphatase activity, which dephosphorylates phosphorylated PrrA without alteration of the PrrB kinase activity. The transmembrane domain of PrrB is required for the enhancement of PrrB phosphatase activity by the $cbb_3$ oxidase.