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Photoinduced electron transfer in cytochrome bc_1: Kinetics of ubiquinone transfer from the Q_o site to the Q_i site, and evidence for communication between the monomers in the dimer

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The electron transfer reactions within wild- type *Rhodobacter sphaeroides* cytochrome bc_1 (cyt bc_1) were studied using a ruthenium dimer to rapidly photo oxidize cyt c_1. It was found that when cyt b_H was initially reduced before the reaction, photooxidation of cyt c_1 led to bifurcated reduction of both the iron-sulfur protein and cyt b_L by QH_2 in the Q_o site, followed by re-oxidation of two equivalents of cyt b_L and cyt b_H. It was proposed that the newly formed ubiquinone diffused through the hydrophobic cavity linking the Q_o site of the reactive monomer A to the Q_i site of the other monomer B, leading to oxidation of cyt b_H in monomer B followed by oxidation of cyt b_L in monomer A by cross-monomer electron transfer. Addition of one equivalent of the Q_i site inhibitor antimycin to the cyt bc_1 dimer had very little effect on any of the electron transfer reactions, while addition of a second equivalent completely inhibited re-oxidation of cyt b_L and cyt b_H. It was also found that addition of one equivalent of the Q_o site inhibitor stigmatellin to the cyt bc_1 dimer completely inhibited all electron transfer reactions in both monomers of the dimer. These experiments are consistent with a half-of-the-sites mechanism in which only one monomer of the dimer is active at a time, implying monomer-monomer interactions. The rapid electron transfer reaction from the ISP to cyt c_1 was found to be greatly decreased by viscosity, indicating a multi-step diffusional mechanism as the iron-sulfur protein rotates from the b state to the c_1 state.

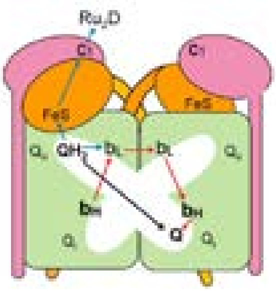

Figure1: *Photoinduced electron transfer in cytochrome bc1: kinetics of ubiquinone transfer from the Qo site to the Qi site, and evidence for communication between the monomers in the dimer*

Biography

Francis Millett received his BS in Chemistry from the University of Wisconsin in 1965, his PhD in Chemical Physics from Columbia University in 1970, and was an NIH Postdoctoral Fellow at California Institute of Technology from 1970-1972. He joined the faculty of the University of Arkansas in 1972, and is now a Distinguished Professor. He developed, together with Bill Durham, the ruthenium photoreduction method which made it possible to measure the kinetics of key steps in electron transfer during mitochondrial oxidative phosphorylation. He has directed collaborative, multidisciplinary research which combines rapid kinetics methods, site-directed mutagenesis, X-ray crystallography, and NMR to investigate protein structure-function relationships.

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