Supplementary Information

Calculated proton uptake on anaerobic reduction of cytochrome c oxidase: Is the reaction electroneutral?

*Yifan Song, Ekaterina Michonova-Alexova and M.R. Gunner**

Physics Department J-419

City College of New York

138th St. and Convent Ave.

New York, NY 10031

Table S1. Comparison of interactions between Heme a_3 and Cu_B in different aquo protonation and cofactor redox states calculated in vacuum by Coulomb's law and DFT using Gaussian98. The Delphi Poisson-Boltzmann (PB) interactions are calculated in *Rb. sphaeroides* cytochrome c oxidase with ε=80 surrounding the protein embedded in a low-dielectric slab with cavities filled with ε=80. The interactions used in MCCE in the pK_a and E_m calculations are given by (ΔG_{PB}*ΔG_{DFT}/$\Delta G_{Coulomb}$). See Materials and Methods for more complete description.

	Coulomb's law ε=1 (ΔpK_a unit)	DFT (ΔpK_a unit)	PB (ΔpK_a unit)	used in MCCE (ΔpK_a unit)
water-Heme a_3 - water-Cu_B(II)	80.4	42.1	15.7	8.2
hydroxyl-Heme a_3 - water-Cu_B(II)	-48.1	-37.9	-9.8	-7.7
water-Heme a_3 - hydroxyl-Cu_B(II)	14.5	-8.4	3.2	-1.8
hydroxyl-Heme a_3 - hydroxyl-Cu_B(II)	-12.4	-7.4	-3.5	-2.1
water-Heme a_3 - water-Cu_B(I)	35.6	17.0	5.1	2.4
hydroxyl-Heme a_3 - water-Cu_B(I)	-10.7	-6.7	-2.5	-1.5
water-Heme a_3 - hydroxyl-Cu_B(I)	-36.3	-23.9	-7.3	-4.8
hydroxyl-Heme a_3 - hydroxyl-Cu_B(I)	18.7	21.4	3.2	3.6
water-Heme a_3 - water-Cu_B(II)-His^-	42.9	12.2	9.1	2.6
hydroxyl-Heme a_3 - water-Cu_B(II) -His^-	-41.8	-28.5	-8.0	-5.4
water-Heme a_3 - hydroxyl-Cu_B(II) -His^-	-23.1	-22.6	-3.4	-3.3
hydroxyl-Heme a_3 - hydroxyl-Cu_B(II) -His^-	-5.8	6.2	-2.0	2.1