Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

MutY: optimized to find DNA damage site electronically?[1] JONG-CHIN LIN, DANIEL COX, RAJIV SINGH — Iron sulfur clusters are present in the DNA repair protein MutY in a region highly homologous in species as diverse as *E. Coli* and Homo Sapiens, yet their function remains unknown. In MutY, this mixed valence cluster exists in two oxidation states, $[Fe_4S_4]^{2+/3+}$, with the stability depending upon the presence of DNA. We have studied the electronic structure and stability of these clusters using the local orbital based SIESTA implementation of density functional theory. We find that the iron-sulfur cluster in MutY can undergo 2+ to 3+ oxidation when coupling to DNA through hole transfer, especially when MutY is near an oxoguanine modified base(oxoG). Employing the Marcus theory for electron transfer, we find (i) near optimal Frank-Condon(FC) factor for 2+ transfer to oxoG; (ii) reduced FC factor for transfer to G due to a high oxidation potential; (iii) reduced FC factor with the mutation L154F; (iv) reduced tunning matrix element with the mutation R149W. Both L154F and R149W mutations dramatically reduce or eliminate repair efficiency. Hence, redox modulation of MutY search and binding appears plausible and may have broader implications for DNA-protein interactions.

[1]Work initiated with the support of NSF grant PHY 0120999 (the Center for Biophotonics Science and Technology).

Jong-Chin Lin
University of California, Davis

Date submitted: 05 Dec 2005 Electronic form version 1.4