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Electron Transfer in Myoglobin-based Single-Electron Transistors[1] DEBIN LI, Dept. of Physics, West Virginia University, PETER GANNETT, Basic Pharmaceutical Sciences, West Virginia University, DAVID LEDERMAN, Dept. of Physics, West Virginia University — The mechanism of electron transfer by myoglobin was investigated using nanometer-gap platinum electrodes fabricated by breaking a small junction by electromigration at cryogenic temperatures. The experimental results suggest single electron transport behavior is mediated by resonance of the electronic levels of the heme group in a single myoglobin protein. Evidence for a two-step electron tunneling process, resulting from the structural relaxation of the protein with the addition of a single electron, was observed. Our experimental results show that the slow protein relaxation may result in resonant tunneling and the fast protein relaxation is the condition of two-step resonant tunneling behavior. The conformation and orientation of myoglobin in the gap of electrodes may significantly affect the conductance of these devices. The calculation for the conductance graph as a function of gate voltage and bias voltage was performed with the rate equations for electron tunneling via discrete quantum states and considering the two-step process. The results of calculation match those of our experiment.

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