Multistep Hopping and Extracellular Charge Transfer in Microbial Redox Chains

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Electronic Supplementary Information (ESI)

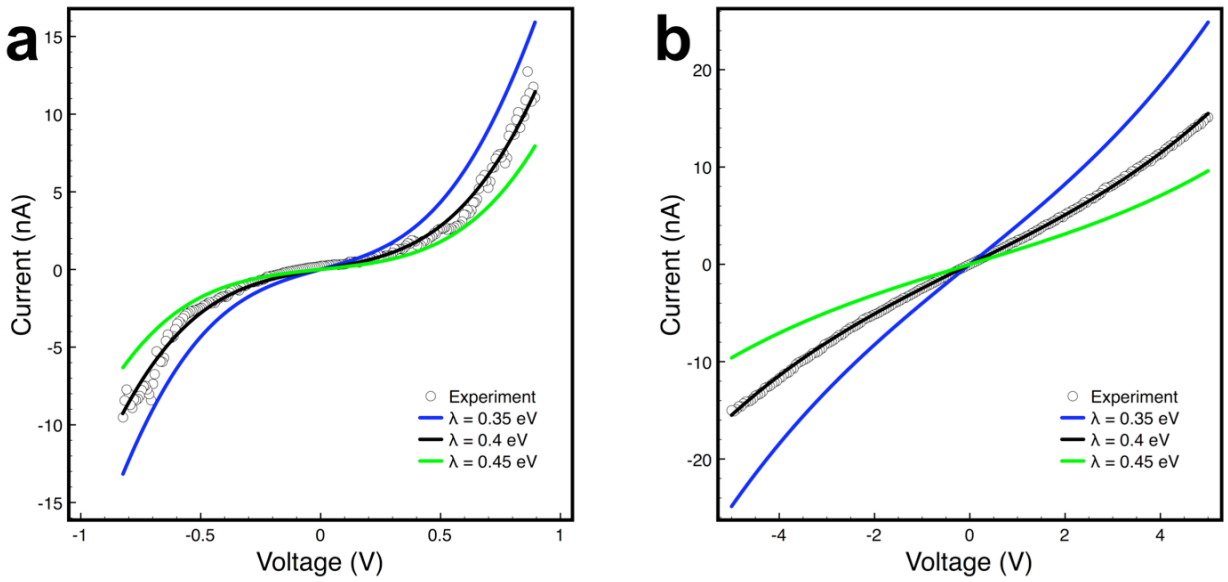

Fig. S1 Sensitivity of the calculation to variations in the reorganization energy λ while keeping the rest of the parameters the same as Figure 5/Table S1. (a) Transverse transport across the thickness of a microbial nanowire, using a conductive tip as the top electrode and a supporting surface as the bottom electrode (Calculation parameters: $L = 10$, $\beta R = 6.5$, $\lambda = 0.35 - 0.45$ eV, $\alpha = 0.3$, $C_{electrode} = 1.8\times10^{10}$ s^{-1}, $k_BT = 0.025$ eV). (b) Longitudinal transport along a microbial nanowire bridging two Pt electrodes (Calculation parameters: $L = 2000$, $\beta R = 6.5$, $\lambda = 0.35 - 0.45$ eV, $\alpha = 0.015$, $C_{electrode} = 5\times10^{11}$ s^{-1}, $k_BT = 0.025$ eV).

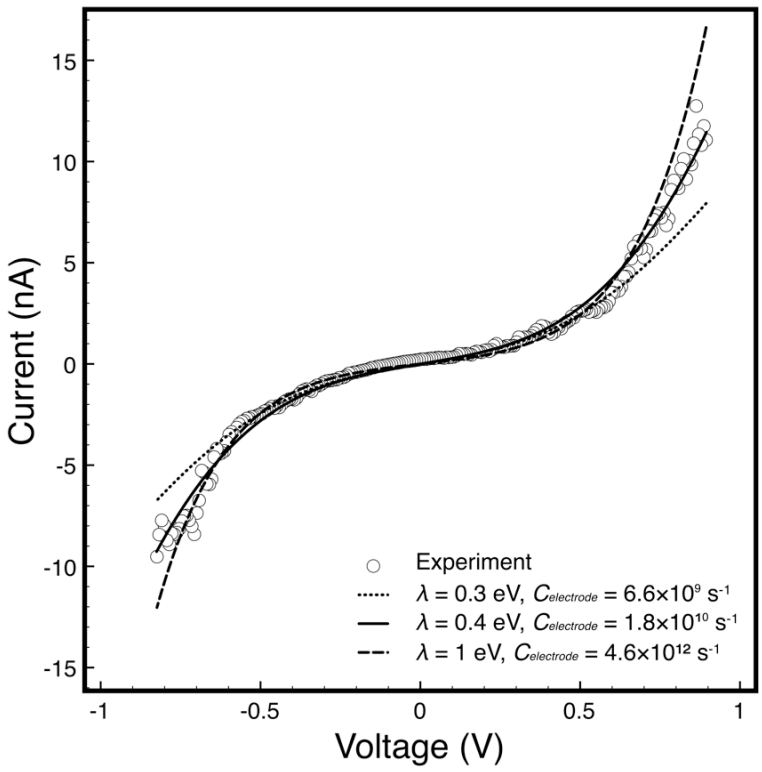

Fig. S2 Best fits to the transverse transport measurement (c-AFM) by simultaneously adjusting the reorganization energy λ and the effective heterogeneous transfer rate $C_{electrode}$. The model fit diverges from the experimental data at high bias for $\lambda < 0.3$ eV and $\lambda > 1$eV, regardless of the assumed heterogeneous transfer rate.

Measurement	R (nm)	L	λ (eV)	α	$C_{electrode}$ (s^{-1})	β ($Å^{-1}$)	k_BT (eV)
Figure 5a – 10 nm transverse	0.65	10	0.4	0.3	1.8×10^{10}	1	0.025
Figure 5b – 2 μm longitudinal	0.65	2000	0.4	0.015	5×10^{11}	1	0.025

Table S1 Simulation parameters used to model the transverse and longitudinal measurements (Figure 5 in the text).