Supporting Information

Harris et al. 10.1073/pnas.0907468107

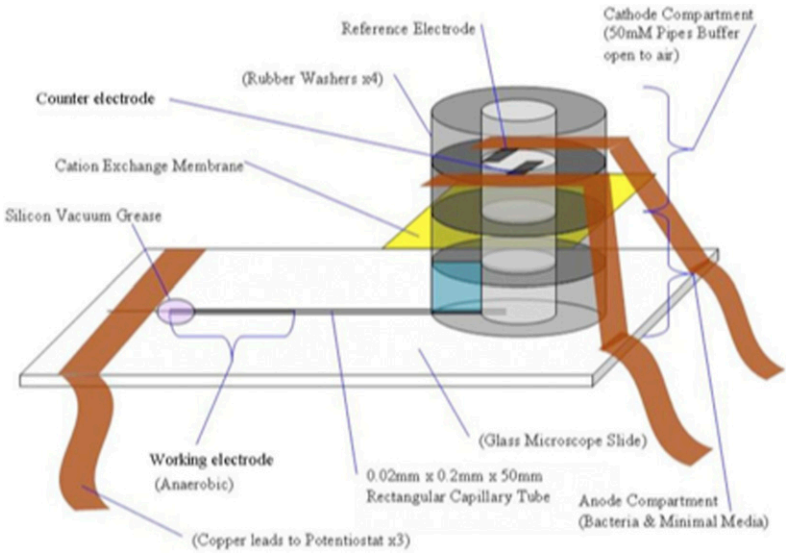


Fig. S1. Schematic of a microelectrochemical cell designed for in situ monitoring of bacteria under different working electrode conditions. Based on a MFC model, this system incorporates a graphite electrode into a thin glass, anaerobic capillary, which allows 100× light microscopy observation of cell motility during various applied potentials.

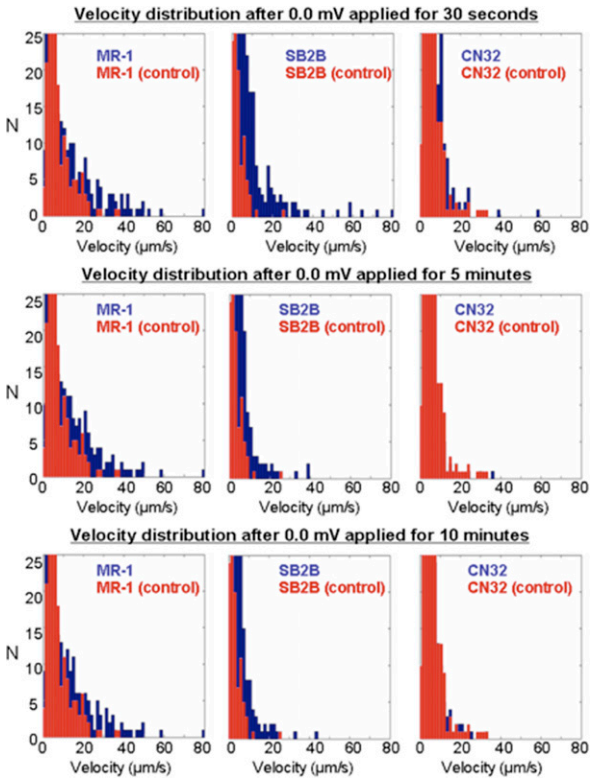


Fig. S2. Graphs showing relaxation times by comparison of velocity distributions. The strains MR-1, SB2B, and CN32 were preexposed to +600 mV applied for 10 min. The experiment began (time 0) after voltage was adjusted to 0.001 mV (Zero mV). The plots show the persistence of swimming in MR-1, SB2B, and CN32 after 30 sec of Zero mV applied (top row), 5 min of Zero mV applied (middle row), and 10 min of Zero mV applied voltage (bottom row). A baseline of nonswimming control (red) was obtained from experimental video data collected at the end of potential interval *x* (i.e., after 10 min of −600 mV exposure) for each strain. Distributions of elevated velocity (blue) over nonswimming control (red) indicate that strains MR-1 and SB2B remained motile for up to 10 min after the exposure to +600 mV applied was terminated, whereas CN32 did not.

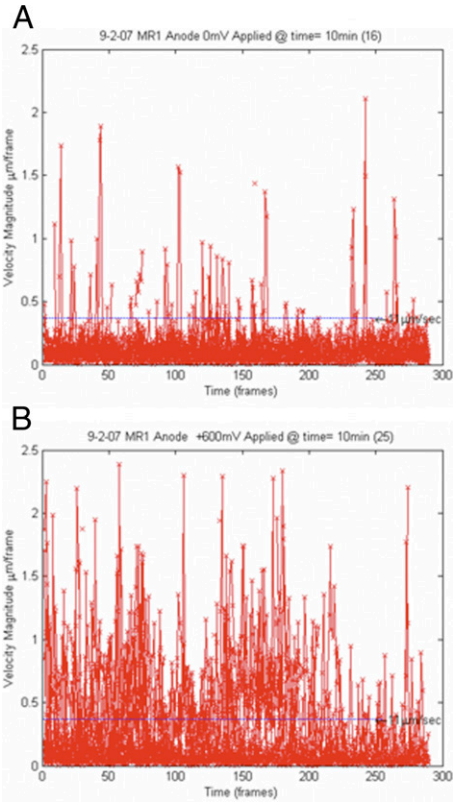
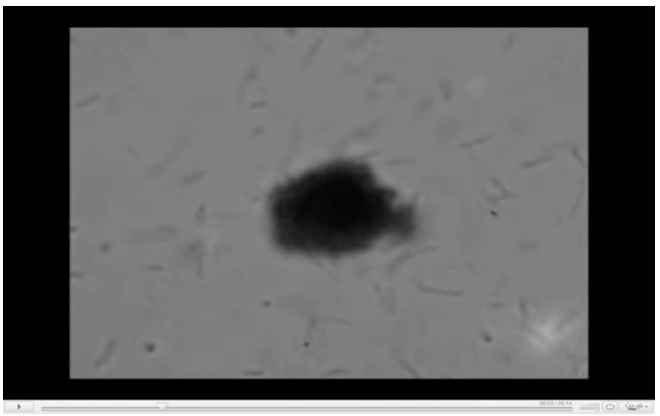
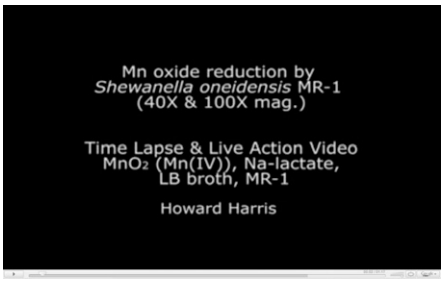


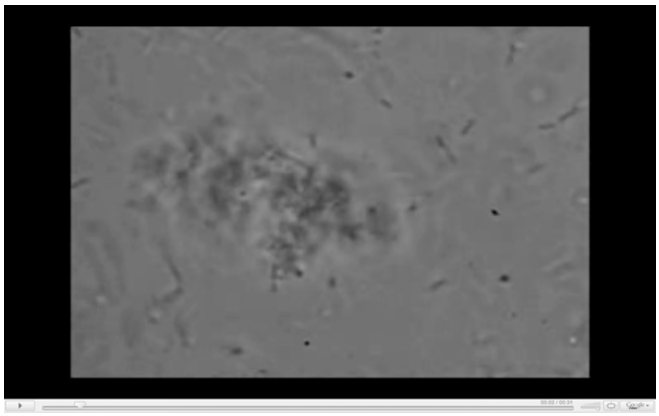
Fig. S3. Tracking microbial velocities. Velocities (expressed as micrometers per frame) of bacteria were extracted from two 10-sec video clips. (*A*) When 0 mV was applied. (*B*) When +600 mV was applied. Many more bacteria are swimming after +600 mV was applied. However, the average swimming velocities of the cells from the two clips does not vary greatly (as would be expected) because our tracking algorithm did not remove data for the large number of cells showing only Brownian motion. Data points for these cells fall below the line on the graph (which represents a swimming speed of 11 μm/sec).



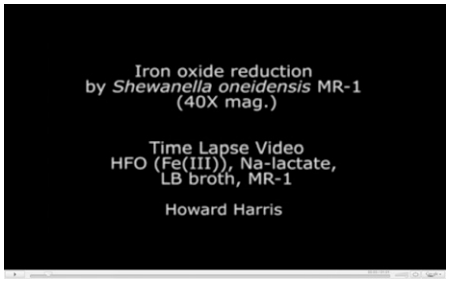
Movie S1. Elecytrokinetic response of *S. oneidensis* MR-1 to MnO_2. MR-1 cells can be seen swimming at speeds of 40–80 μm/sec around a MnO_2 particle (center). The bacteria for this experiment were sealed in an anaerobic capillary tube, with 20 mM lactate as the carbon source, ≈15 min before recording. Touch-and-go behavior, in which the bacteria briefly contact the metal oxide surface, was observed for the next 2 h. Video was recorded using 100× optical microscopy.Movie S1.



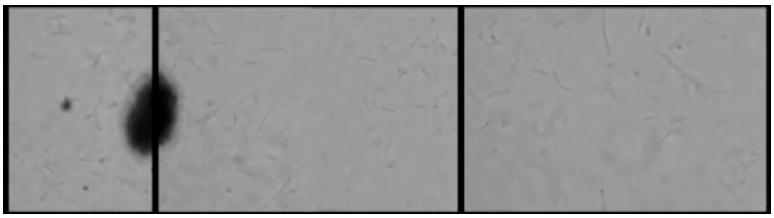
Movie S2. *S. oneidensis* MR-1 reducing a MnO_2 particle. MR-1 cells can be seen swimming at speeds of 40–80 μm/sec around a MnO_2 particle as it is being reduced. The bacteria for this experiment were sealed in an anaerobic capillary tube, with 20 mM lactate as the carbon source, ≈15 min before recording. The tube remained sealed until the MnO_2 particle was fully reduced. Video was recorded using a combination of 40× and 100× optical microscopy to allow observation of the particle reduction and the microbial response, respectively.Movie S2.



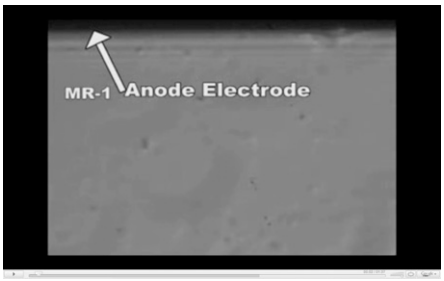
Movie S3. Response of *S. oneidensis* MR-1 to an $Fe(OH)_3$ particle. The $Fe(OH)_3$ particle elicited a considerably diminished motility response relative to MnO_2 exposure in the surrounding MR-1 cells; however, the bacteria did show some motility proximal to the particles.Movie S3.



Movie S4. *S. oneidensis* MR-1 slowly reducing a $Fe(OH)_3$ particle. The $Fe(OH)_3$ particle showed significant reduction over the course of 10 days in the time-lapse video. This bacterial reduction took more time (approximately 2 weeks) relative to the "rapid" (18 h) reduction of a similarly sized MnO_2 particle (Movie S2). Movie S4.



Movie S5. Panoramic view of the electrokinetic response of *S. oneidensis* to a MnO_2 particle. This composite video panorama of the MR-1 motility response to MnO_2 was generated by playing three separately recorded videos, with different fields of view, together at the appropriate scale on one black backdrop. The first of the three video screens has been bisected in the center of the metal particle. This movie scene was analyzed and converted into a contour map, presented in the main text as the "top panoramic strip" of Fig. 1*B*, where the regions of high bacterial traffic around the MnO_2 particle are shown in red.Movie S5.



Movie S6. Electrokinetic response of *S. oneidensis* MR-1 to applied potentials in a microelectrochemical cell. Initially no potential is applied, and a nonmotile population of cells can be observed. Subsequently potentials of +600 and +300 mV are applied, resulting in a highly motile population of cells close to the electrode. Dropping the potential to 0 and −300 mV resulted in an almost totally nonmotile population of cells. Finally the applied potential is returned to +600 mV, and the cells can be seen to become motile again.Movie S6.