Supplementary

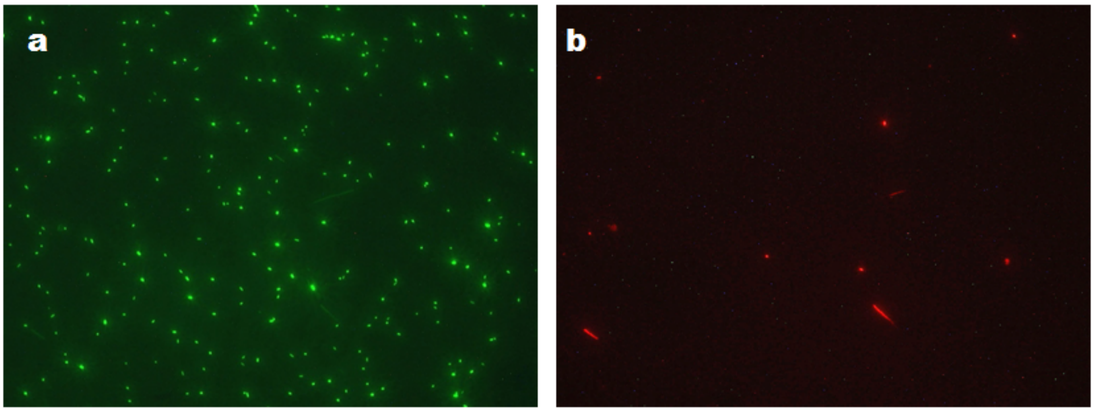
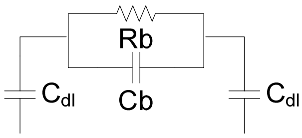


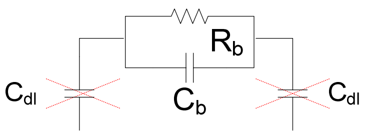
Fig. S1 Viability of *E. coli* rosetta was ascertained with a live/dead stain in PBS. The E. coli cells were isolated from culture media and placed into PBS. The cells were stained with BacLight Bacterial Viability Kit stains at various time points (0, 1, 3, 6, and 26 hours) to determine viability. Panel A is a 40x magnification showing the results for live cell after 26 hours exposure to PBS (255 live cells) and Panel B is the corresponding image for dead cells (19 dead cells). Greater than 92% viability was obtained after 26 hours. A minimum of 3 samples were tested for each time point.

Note S1 The system involving sensing electrodes and bulk media can be represented with an equivalent circuit

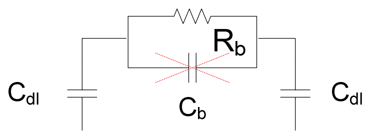


where R_b and C_b are the bulk resistance and capacitance of the conductive media and C_{dl} represents the double layer capacitance at the sensing electrodes[1]. The main advantage of the 4-electrode setup is that the double layer capacitance at the current electrodes does not play a part since the current and sense electrodes are physically separated and therefore it can be ignored. The equivalent impedance (Z_{eq}) consists of the R_b in parallel with C_b.

4 Electrode



2 Electrode



The LCR meter measures the real R_M and imaginary X_M components of the equivalent circuit impedance ($Z_{eq} = R_M + jX_M$) which are related to the bulk counterparts by

$$R_M = \frac{R_b}{1 + \omega^2 R_b{}^2 C_b{}^2} \qquad X_M = \frac{-\omega R_b{}^2 C_b}{1 + \omega^2 R_b{}^2 C_b{}^2}$$

The two equations can be solved to find the desired R_b and C_b using

$$R_b = \frac{R_M{}^2 + X_M{}^2}{R_M} \qquad C_b = \frac{-X_M}{\omega(R_M{}^2 + X_M{}^2)}$$

In the 2-electrode system the current and sense electrodes are the same and therefore double layer capacitance cannot be ignored, especially at the low signal frequencies used in this study (1kHz). In the simplest approximation, C_b is generally negligible as compared to C_{dl} and may be ignored. The equivalent circuit thus includes R_b in series with C_{dl} (at each electrode). The resistance and capacitance measured by the LCR in this case are related to the circuit elements through

$$R_b = R_M \qquad C_{dl} = \frac{-1}{\omega X_M}$$

REFERENCES

1 A. J. Bard and L. R. Faulkner, *Electrochemical methods*, Wiley New York, 2001.