Supporting Information for:

Physical Insights from Frumkin Isotherm Applied to Electrolyte Gated Organic Transistor as Protein Biosensors.

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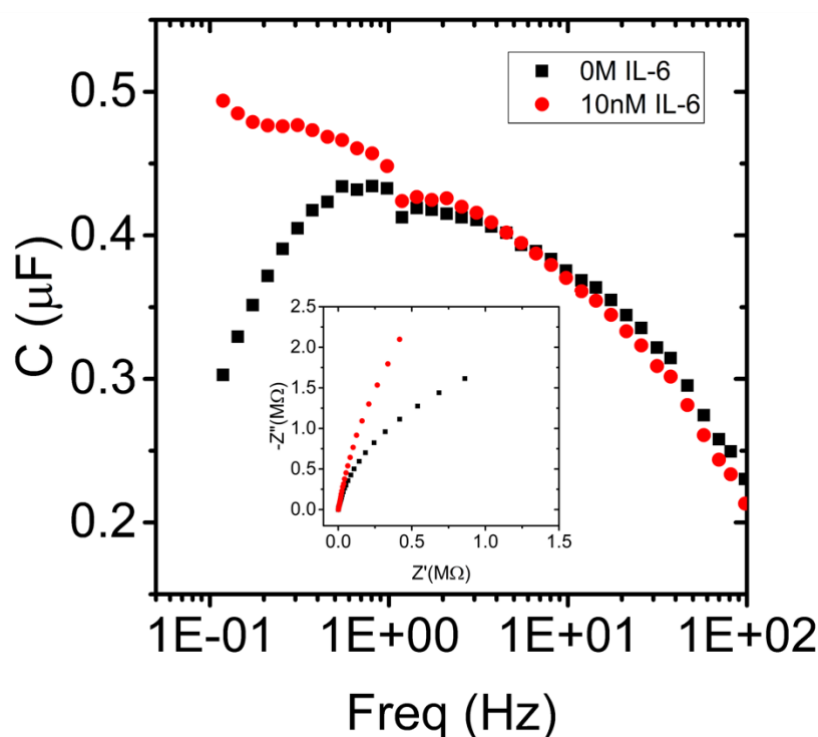
Figure S1. Complex capacitance[1] of the gate electrode, at 0 M (black) and 10 nM IL-6 (red), determined by non-faradic electrochemical impedance spectroscopy. In the inset the relative Nyquist plot. The measurements were performed in 10 mM PBS pH 7.4, applying a potential of +100mV vs Pt electrode, with an amplitude of 5 mV.
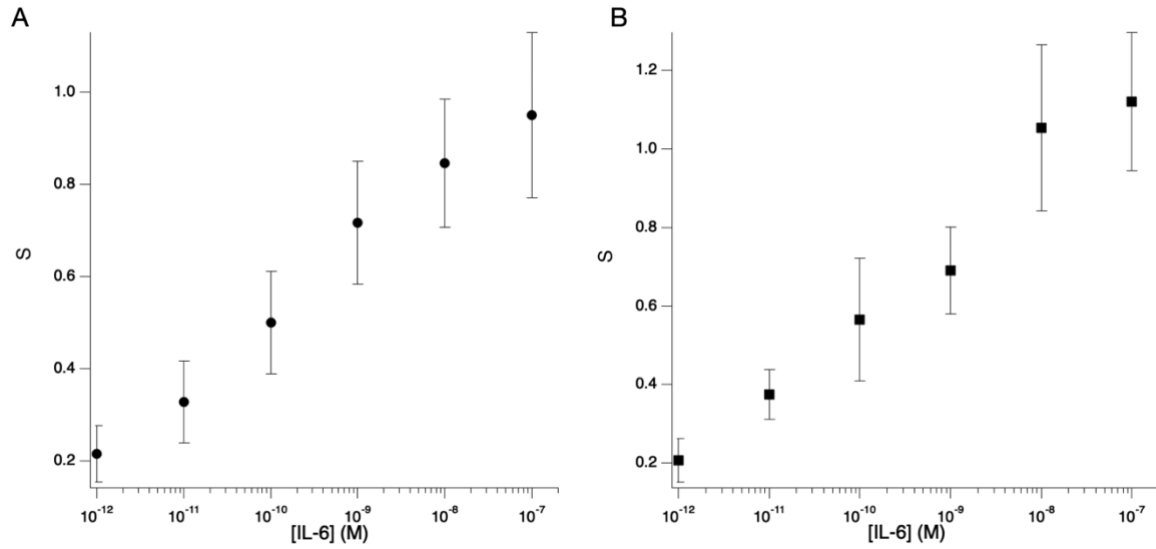
Figure S2. Dose curves S vs [IL-6] for OECT (A) and EGOFET (B) at V_{GS}= +0.3V and V_{GS}= -0.3V, respectively. The experimental values are the average of the measurements performed for five (n=5) OECT and n=5 EGOFET devices, except for [IL-6] = 100 nM for EGOFET for which n=4. Error bars represent the associated standard error.

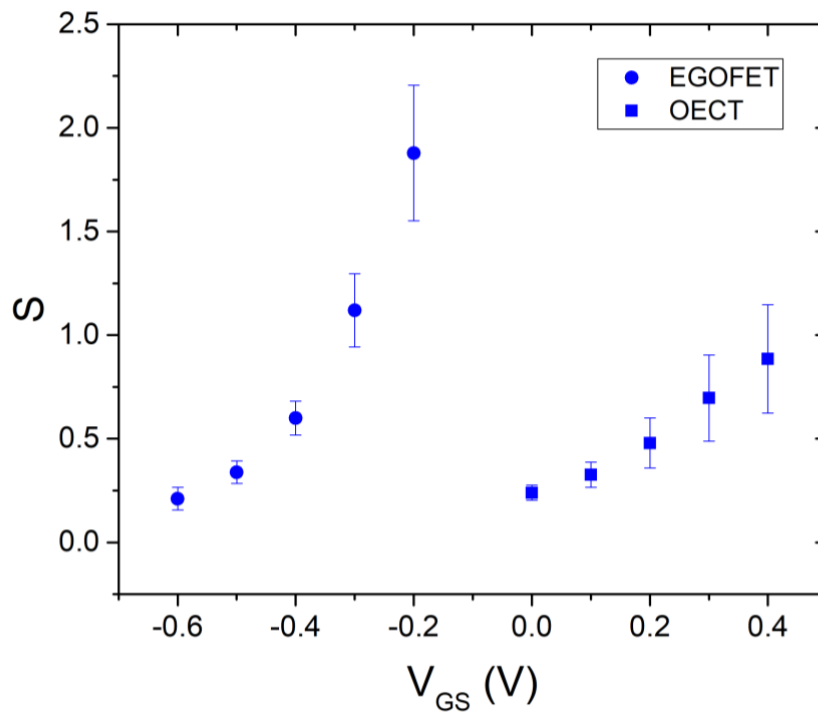**Figure S3.** Dependance of S (blue squares and blue circles for OECT and EGOFET, respectively) vs V_{GS}. Error bars represent the associated standard error of the mean (SEM).
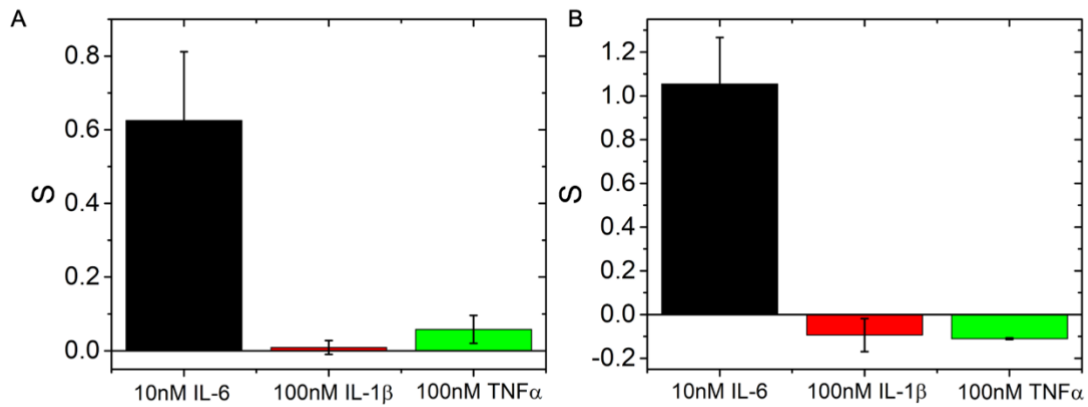
Figure S4. Control experiments: comparison of the signal *S* for OECT (A) and EGOFET (B) after exposing gate electrodes functionalized with anti-IL-6 antibodies to 10nM IL-6 (black) and high concentration (100 nM) of IL-1β (red) and TNFα (green).
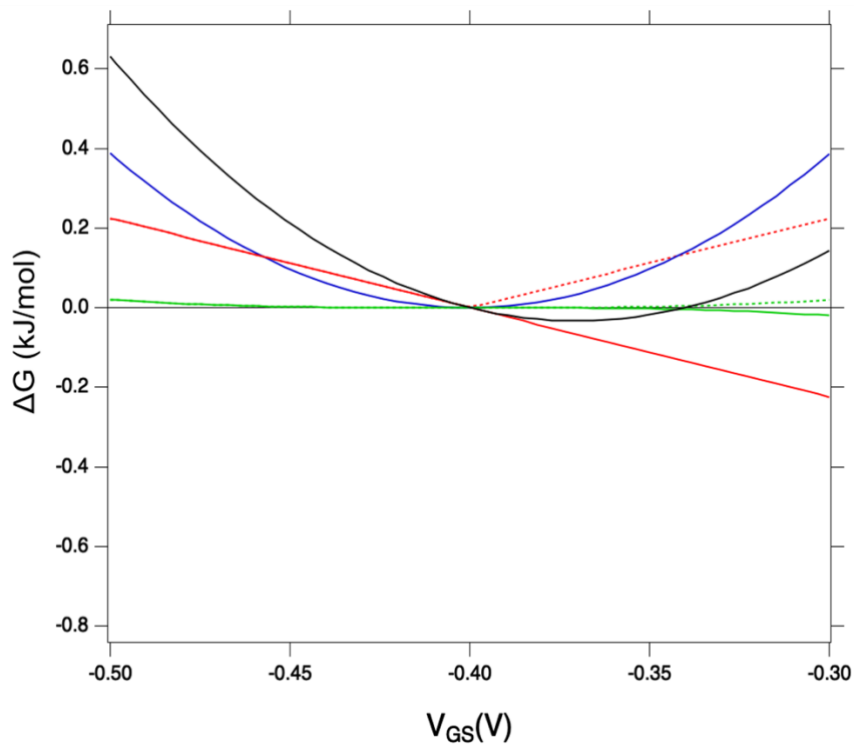

Figure S5. Contributions to the total (black line) electrostatic free energy: charge contribution (continuous red line, dotted red line is the corresponding absolute value); capacitance contribution (continuous blue line) and change in capacitance dC/dV_{GS} (continuous green line, dotted green line is the corresponding absolute value).
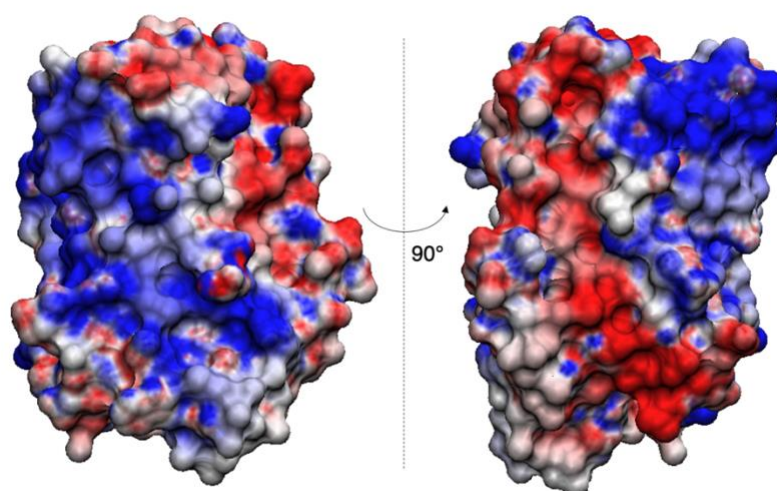
Figure S6. Calculated electrostatic potential for IL-6 mapped on its molecular surfaces. Potential values lower than –5 kT/e are colored in red, potential values higher than +5 kT/e are depicted in blue. The electrostatic properties were investigated using the APBS software. The pqr input file required to run APBS was prepared using PDB2PQR (43). The electrostatic potential was obtained by solving the linearised Poisson–Boltzmann equation at 298.5 K, using dielectric constant values of 2 and 78.54 for protein (solute) and solvent, respectively.

References

1.   Ibau, C. *et al.* Immunosensing prostate-specific antigen: Faradaic vs non-Faradaic electrochemical impedance spectroscopy analysis on interdigitated microelectrode device. *Int. J. Biol. Macromol.* **162**, 1924–1936 (2020).