Supplementary Information

Understanding Electrochemical Properties of Supported Lipid Bilayers Interfaced with Organic Electronic Devices

Zixuan Lu,[a] Douglas Van Niekerk, [a] Achilleas Savva,[a] Konstantinos Kallitsis,[a] Quentin Thiburce,[b] Alberto Salleo,[b] Anna-Maria Pappa [a,c,d] and Róisín M. Owens [a]

a. Department of Chemical Engineering and Biotechnology, University of Cambridge, Cambridge CB30AS, United Kingdom.
b. Department of Materials Science and Engineering, Stanford University, Stanford, California 94305, United States
c. Healthcare Innovation Engineering Center, Khalifa University, Abu Dhabi, United Arab Emirates
d. Department of Biomedical Engineering, Khalifa University of Science and Technology, PO BOX 127788, Abu Dhabi, United Arab Emirates

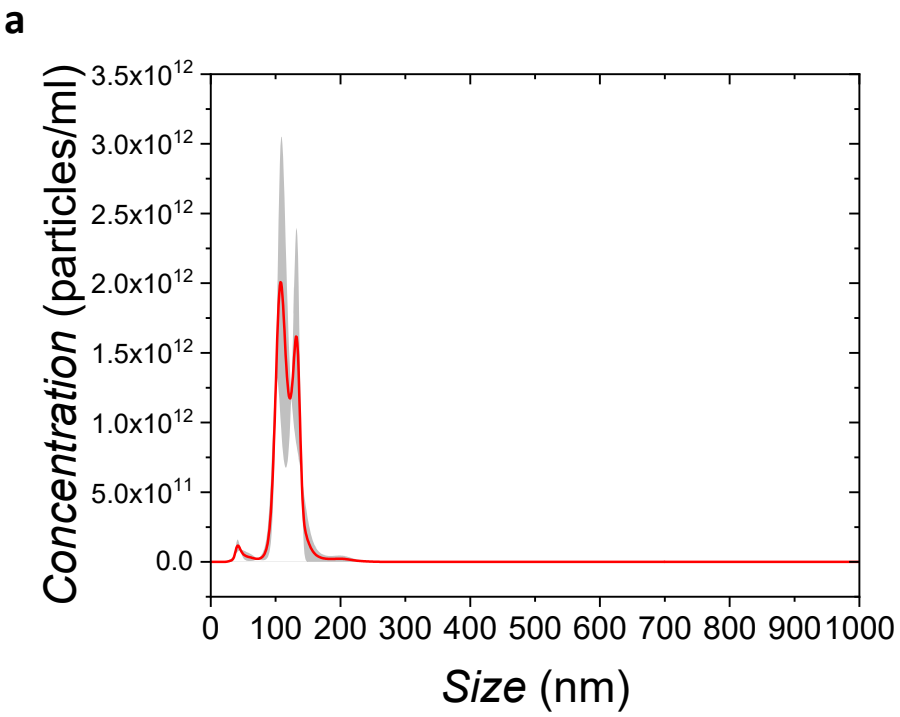

Figure S1: The determination of size and concentration of DOPC:DOTAP (4:1) liposomes via nanoparticle tracking analysis (NTA) measurement (The errors are standard error of mean represented by grey shading areas. n = 2). The mean size is 117 ± 0.8 nm.

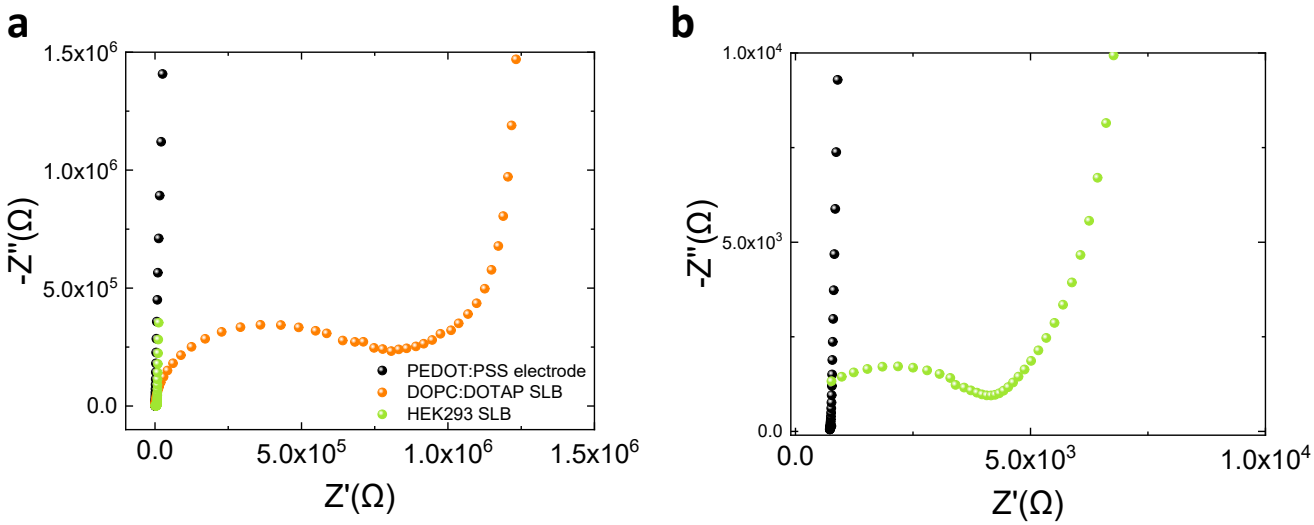

Figure S2: Nyquist plots of HEK293 SLB and DOPC:DOTAP SLB (supplementary to Figure 1b and 1c).

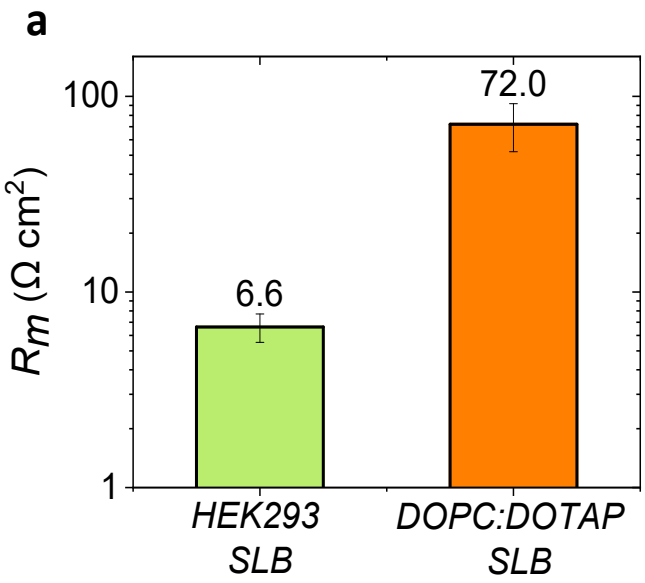

Figure S3: the statistical summary of membrane resistance of HEK293 SLB and DOPC:DOTAP SLB. The labelled values are the averages of the membrane resistance values, and the error bars show the standard errors of mean (n ≥ 6).

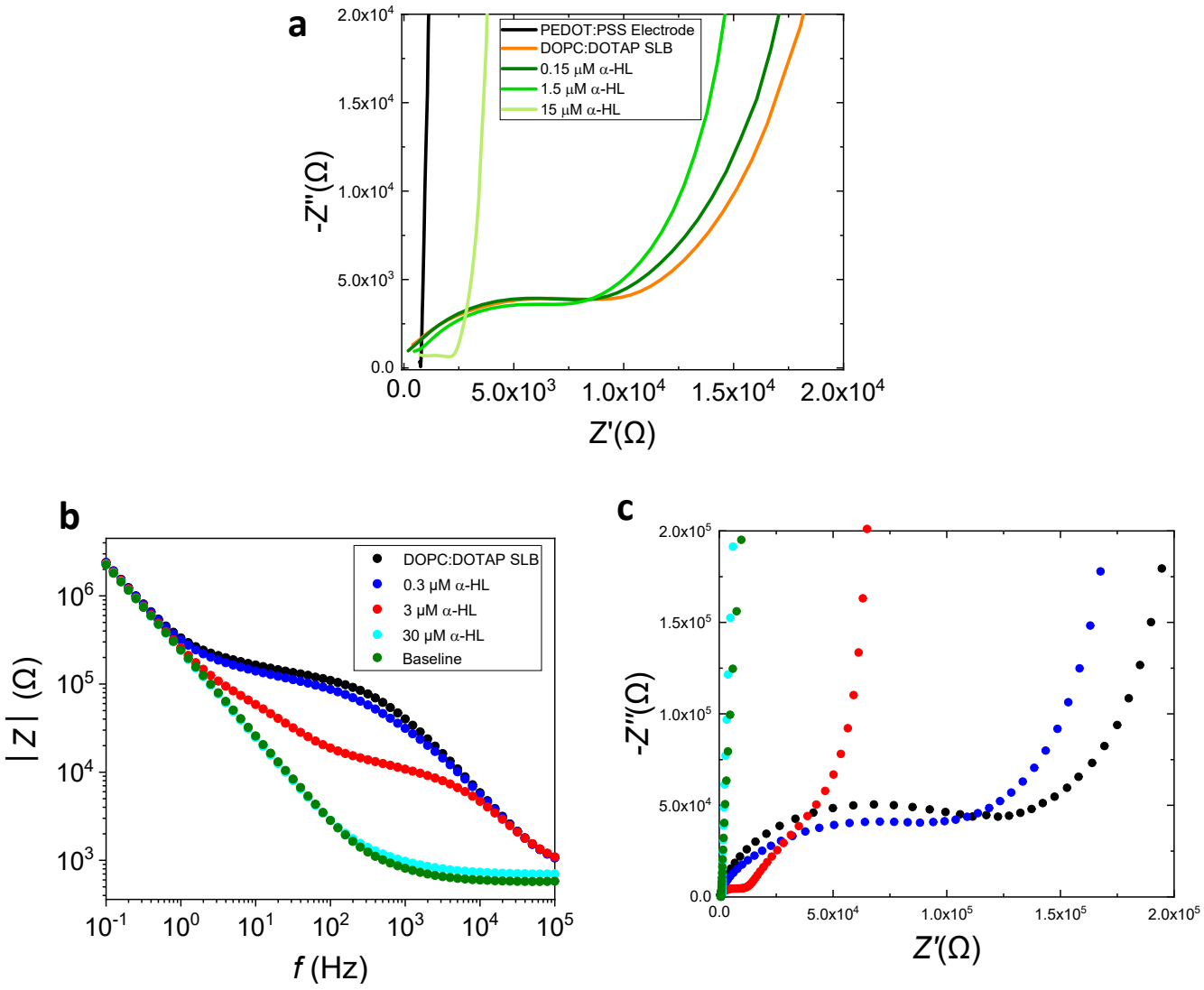

Figure S4: (a) The Nyquist plot of dose response of α-HL (supplementary to Figure 1e), carried out at 37°C. (b - c) Dose response of impedance spectroscopy with α-HL on DOPC:DOTAP SLB at room temperature: (b) Bode plot; (c) Nyquist plot.

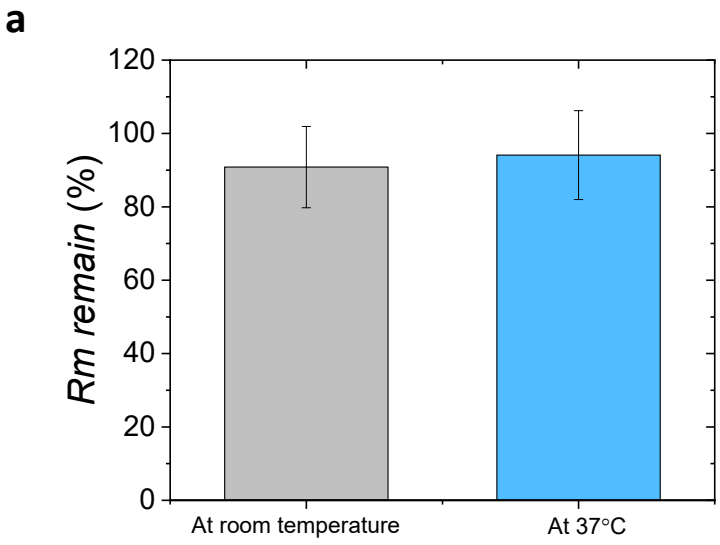

Figure S5: the DOPC:DOTAP membrane impedance is measured at t = 0 and t = 1hr. The plot illustrates the change from the initial measurement (100%) after 1 hour incubation at room temperature (22 °C) and 37°C (n ≥ 9).

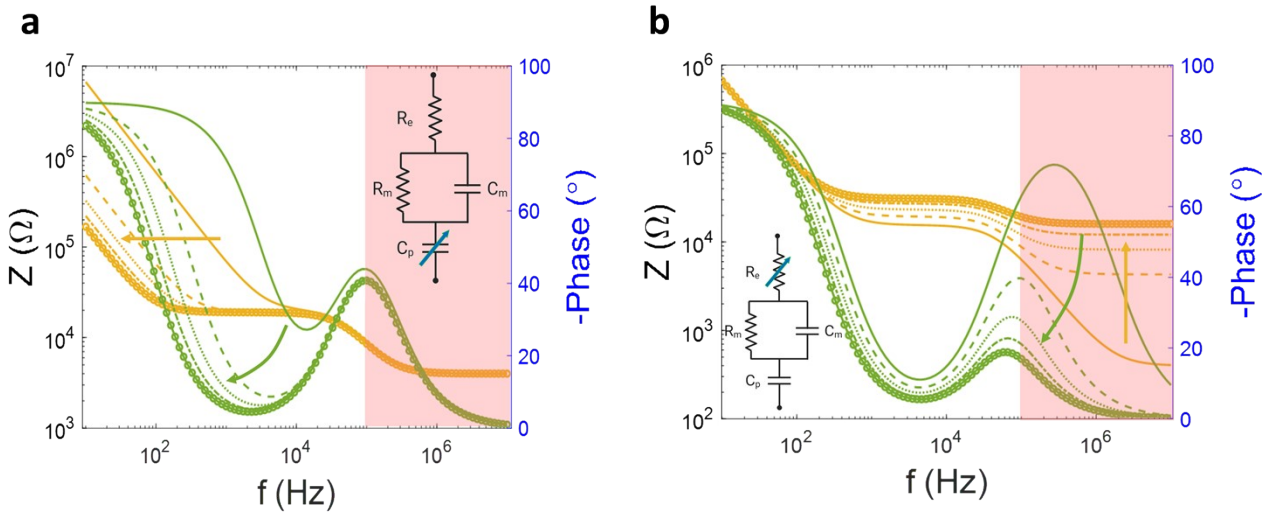

Figure S6. a-b) Simulated impedance spectra with respect to changes in design-dependent system parameters (Cm = 1.5nF, Rm = 15kΩ). Impedance magnitude is plotted in orange and phase in green. Red regions indicate regions above the measurement capabilities of the instruments used. Arrows indicate the direction of increasing size of the parameter of interest.(a)Impedance spectra as a function of changing PEDOT:PSS capacitance, Cp={0.1-4} x 0.15µF; (b) Impedance spectra as a function of changing electrolyte resistance, Re={0.1-4} x 4kΩ;

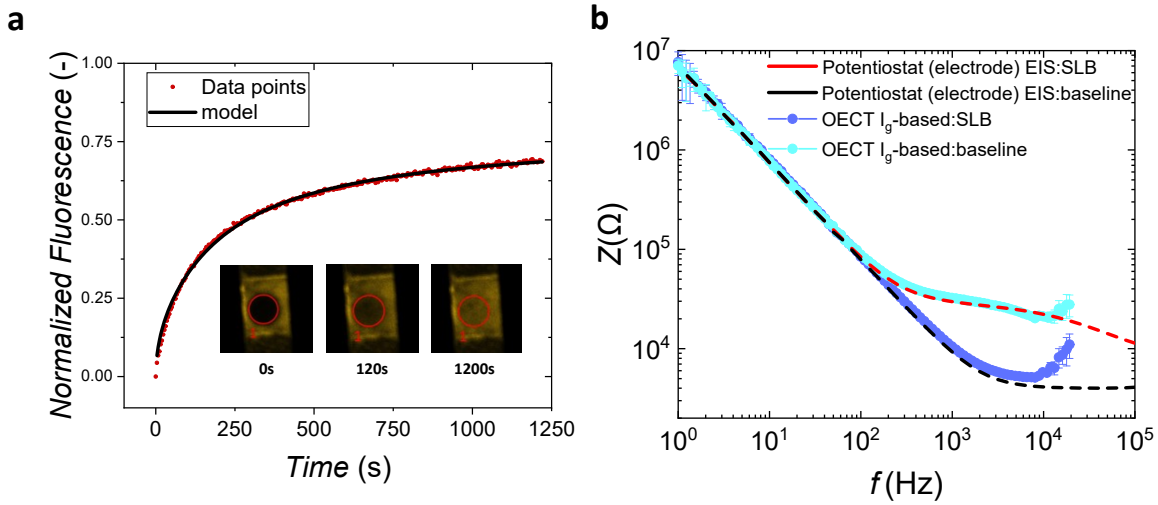

Figure S7: a) The FRAP on DOPC:DOTAP SLB on an OECT channel with 0.34 μm^2/s diffusivity (D) and 0.78 mobile fraction (MF). b) The agreement of OECT Ig-base impedance measurement with potentiostat EIS measurement (electrode) on the same OECT channel and DOPC:DOTAP SLB is shown by overlapping of the curves.

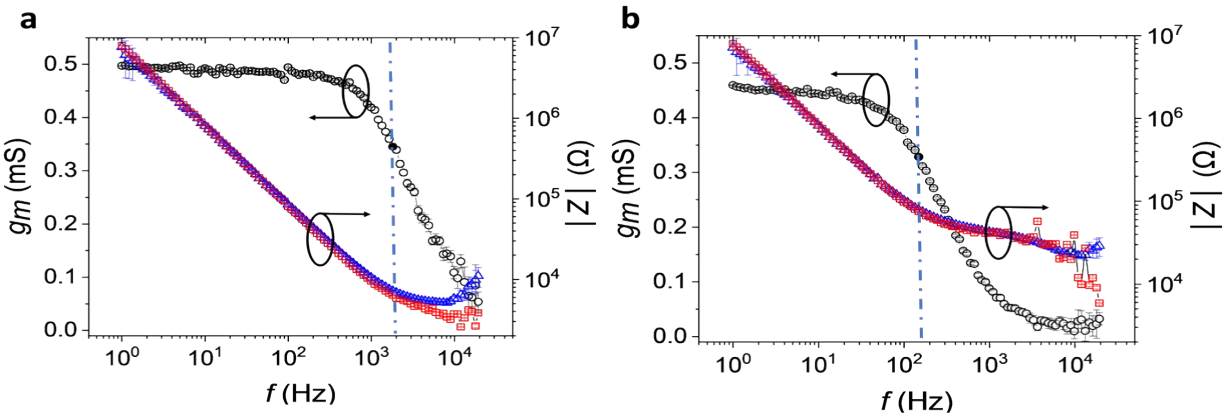

Figure S8: The overlapping of bandwidth (gm-frequency) and impedance-frequency plots from OECT: (a) before DOPC:DOTAP SLB formation; (b) after DOPC:DOTAP SLB formation. The black circles represent bandwidth measurements. The blue triangles represent I_G-based spectrum (electrode). The red squares represent I_d-based spectrum (OECT) (The ellipses attached with arrows point to the corresponding axis of the curve).

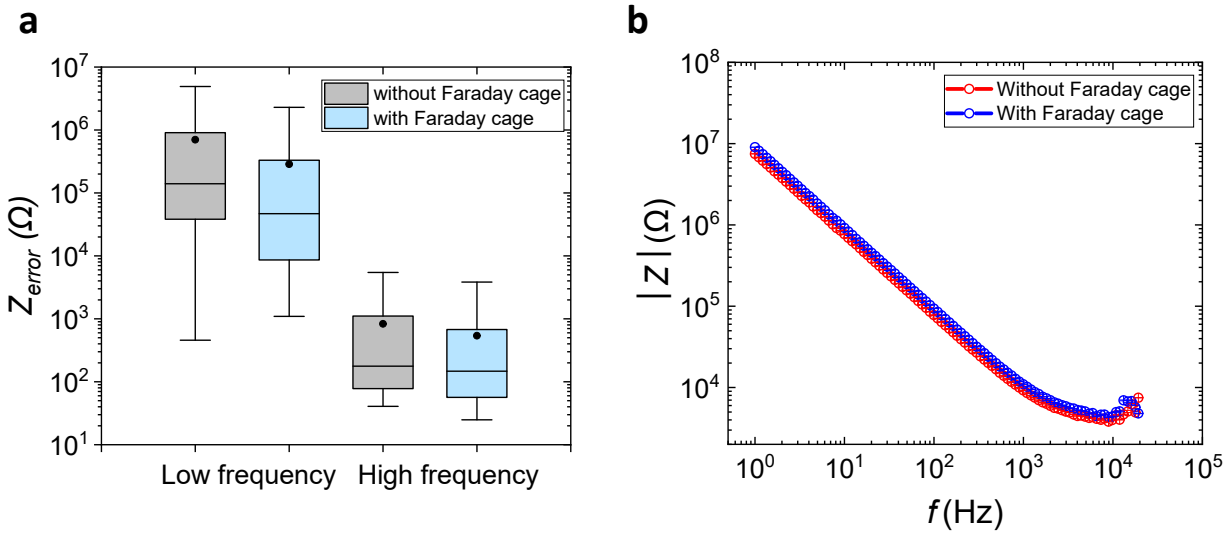

Figure S9: a) The box plot of low and high frequency of I_g-based (electrode) spectra (supplementary to Figure 3c. f = 60 Hz as boundary) error-reducing effect by operating measurement in Faraday cage (grey box: measure without Faraday cage, and blue box: measure within Faraday cage. The bar range, box, dot, and line represent maximum to minimum range, 25%-75% of the data points, mean, and median values, respectively). The low frequency statistic is calculated from 42 data points and high frequency statistic is from 58 data point of a representative impedance spectra. b) The noise and propagation error of I_d-based OECT spectra with and without Faraday cage.