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Supporting Information

Robust Biosensor Based on Carbon Nanotubes/Protein Hybrid Electrolyte Gated Transistors

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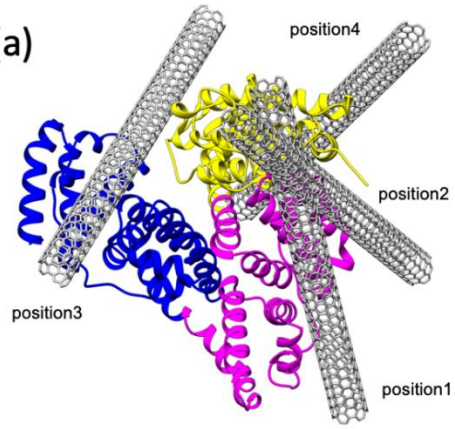
(a)



(b)

Position	van der Waals	Polar Solvation	Non-polar Solvation	$E_{binding}$
1	-176.2	51.6	-8.5	-133.1
2	-135.1	47.2	-6.4	-94.3
3	-178.8	47.8	-7.3	-138.4
4	-127.5	37.9	-6.3	-95.9

Figure S1 (a) Best poses obtained by the docking procedure for the interaction between (6,5) SWCNT and BSA. In yellow Domain I, in magenta Domain II and in blue Domain III of BSA. (b) Computed binding energy ($E_{binding}$) and its contributions i.e., van der Waals, polar solvation and non-polar solvation for the interaction of the (6,5) SWCNT in the different regions of BSA. All energies are reported in kcal mol^{-1}.

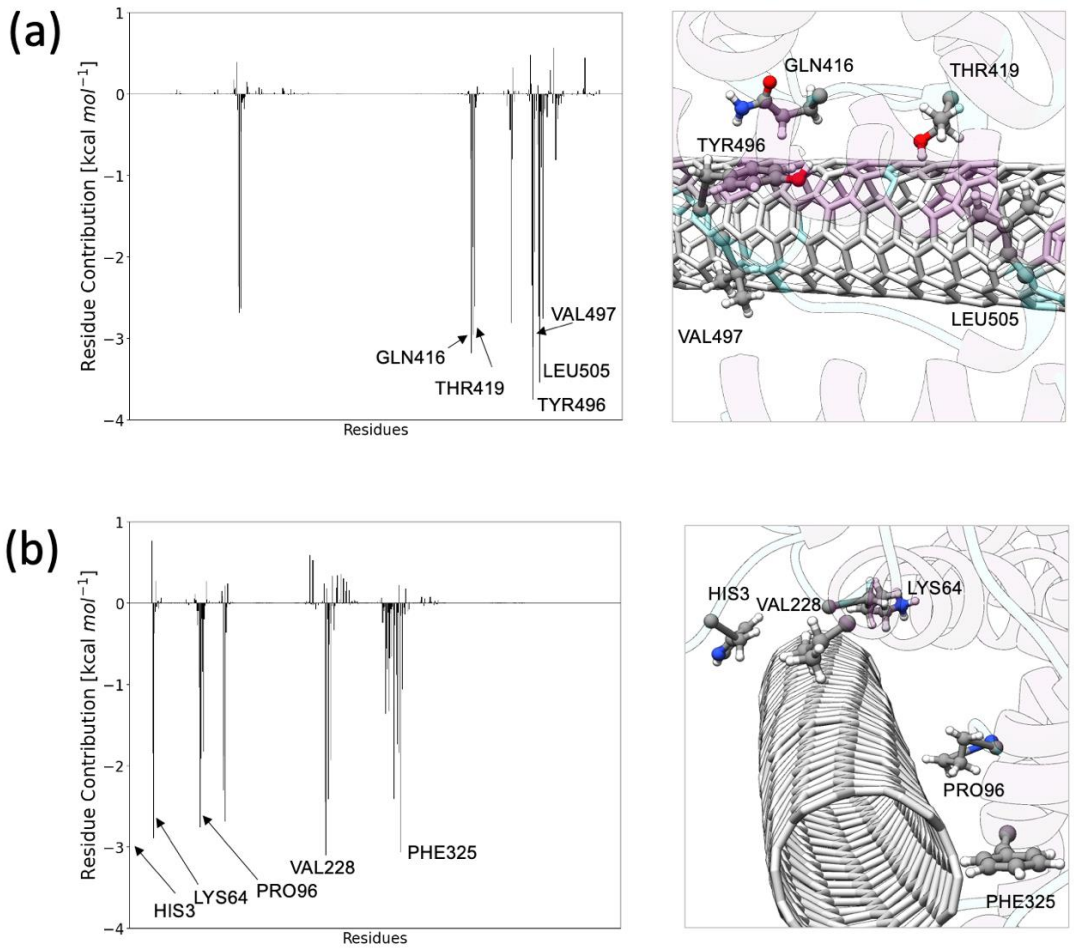


Figure S2 (a) $\Delta E_{binding}$ for (6,5) SWCNT in position 3, *i.e.* (6,5) SWCNT in the BSA cleft region between the Domains I and III, decomposed per residue. The five residues with higher interaction are shown in the cartoon. (b) $\Delta E_{binding}$ for (6,5) SWCNT in position 1, *i.e.* (6,5) SWCNT passing through Domain I and II of the BSA, decomposed per residue. The five residues with higher interaction are shown in the cartoon.

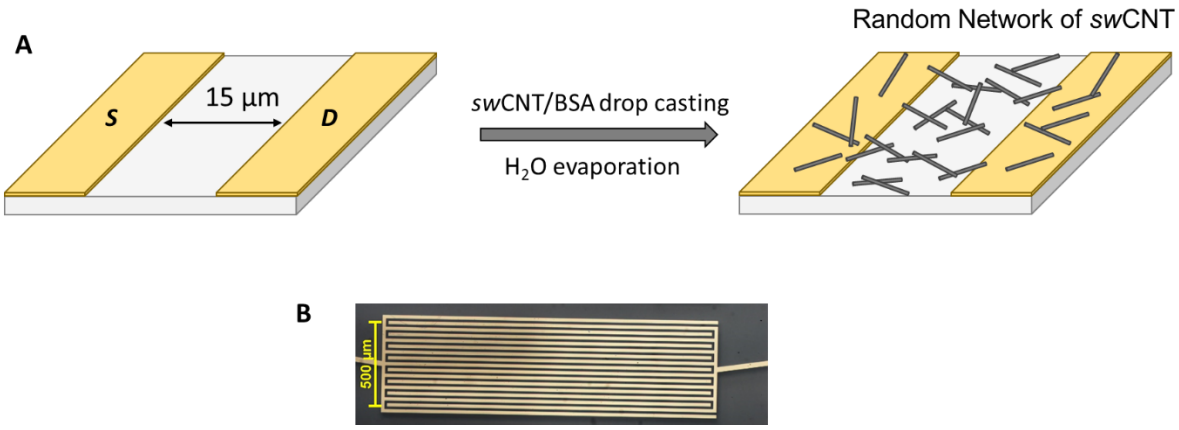


Figure S3 Scheme representing the formation of the single wall carbon nanotubes (SWCNT) random network between the source/drain electrodes. The network was prepared by drop casting a solution of SWCNT/BSA adducts on the substrate surface (A). Optical microscope image of the interdigitated gold source/drain electrodes (B).

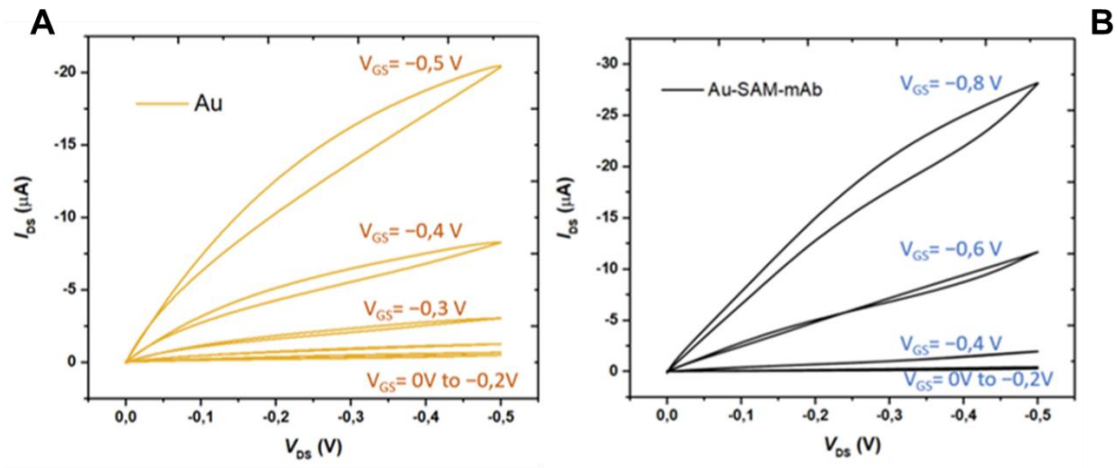


Figure S4 Output characteristic curves at different V_{GS} potentials of (A) the SWCNT/BSA transistor with a bare gold gate electrode and (B) with a gold gate electrode functionalized with the self-assembled monolayer and anti-cortisol monoclonal antibodies (SAM-mAB).

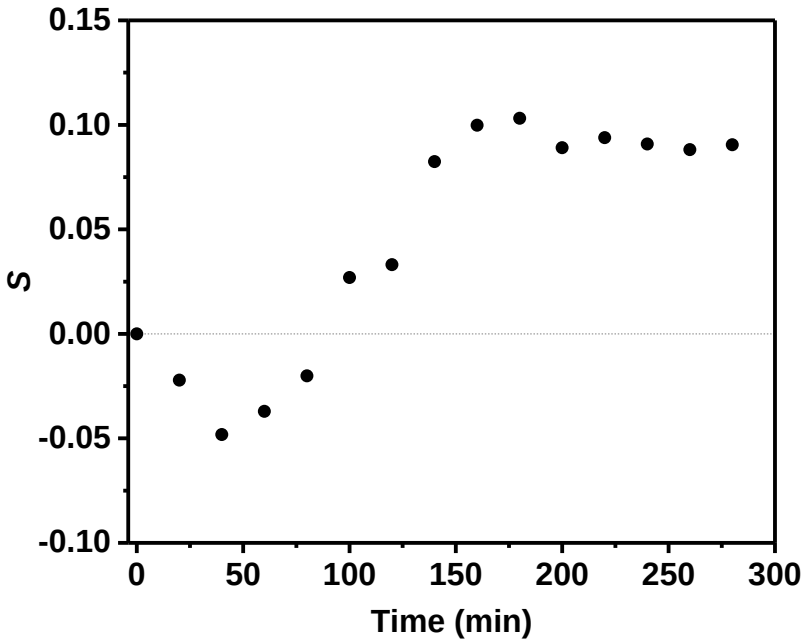


Figure S5 Normalized current change ($S = -(I_{DS}-I_{DS0})/I_{DS0}$) for the SWCNT/BSA EGT device, using an Ag/AgCl electrode as gate electrode and 50 mM phosphate buffer pH 7.4 as electrolyte. S was calculated at V_{GS} = –0.500 V and V_{DS} = –0.050 V over 4.5 h, recording consecutive transfer curves with 5 min intervals between each collection.

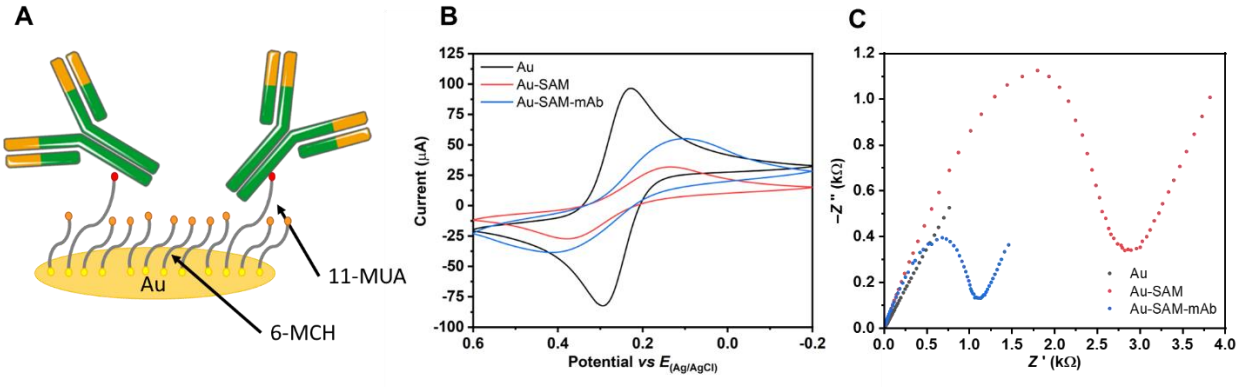


Figure S6 Scheme representing the Au gate electrode functionalized with cortisol monoclonal antibodies (green/orange cartoons) covalently attached a self-assembled monolayer (SAM) of 11-MUA and 6-MCH formed on the Au surface (A). Cyclic voltammetry of the functionalized Au gate electrode using $K_3[Fe(CN)_6]$ as redox probe: bare gold (black trace), Au covered with SAM (red trace) and Au covered with SAM and monoclonal antibodies (blue trace) (B). Nyqyst plot of the electrochemical impedance spectroscopy of the functionalized Au electrode using $K_3[Fe(CN)_6]$ as redox probe (C).

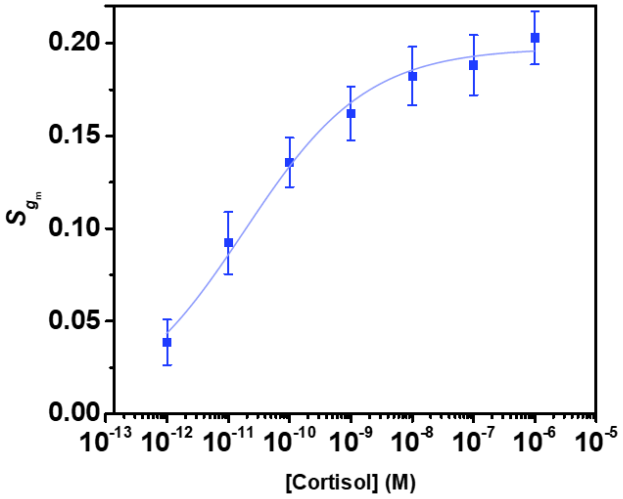


Figure S7 Normalized transconductance change ($S_{gm} = -(g_m - g_{m0})/g_{m0}$), against cortisol concentration, calculated at $V_{GS} = -0.8$ V, with associated standard errors.

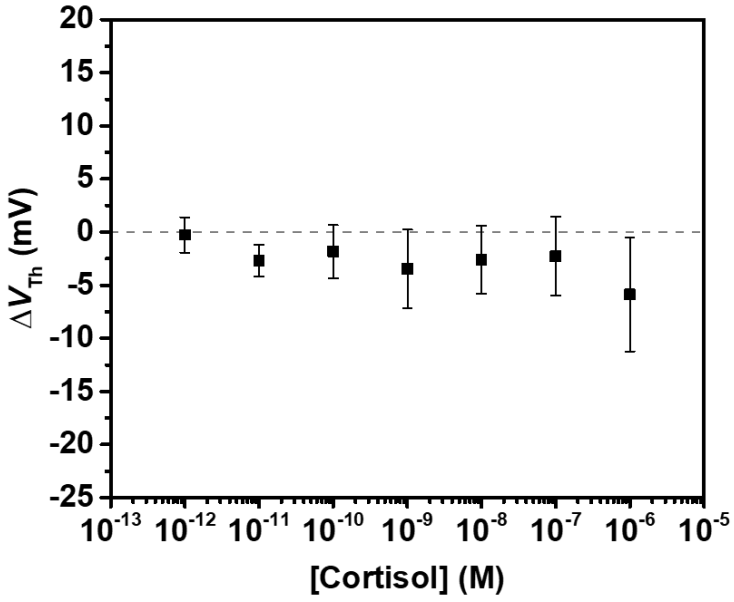


Figure S8 Average threshold voltage shift (n=8 independent experiments), with respect to the blank buffer, as function of cortisol concentration together with their associated standard errors.

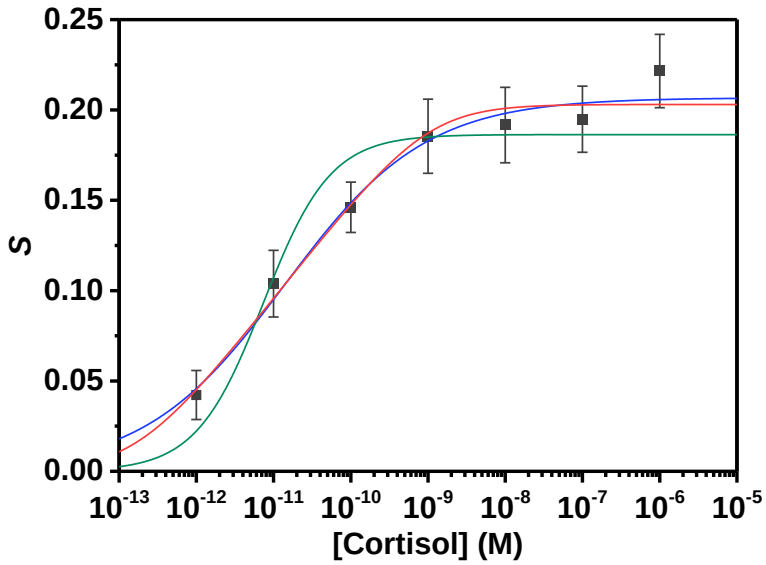


Figure S9 Fitting of the signal (extracted at V_{GS}= –0.8 V) calibration curve with a Langmuir isotherm (green trace), Hill isotherm (blue trace) and Uniform Langmuir isotherm (red trace). The obtained fitting parameters are reported in Table **S1**.

Table S1 Best fitting parameters obtained from the Langmuir, Hill and uniform Langmuir isotherms fit, together with their estimated errors and goodness-of-fit parameters.

	Langmuir	**Hill**	**Uniform Langmuir**
	$S = S_{max}\frac{K_a\,c}{1+K_a\,c}$	$S = S_{max}\frac{K_a^{\alpha}\,c^{\alpha}}{1+K_a^{\alpha}\,c^{\alpha}}$	$S = \frac{S_{max}}{2A}ln\left(\frac{1+K_{avg}\,e^{A}\,c}{1+K_{avg}\,e^{-A}\,c}\right)$
K_a **(×10^{10})**	11 ±5	7 ±1	8 ±1
α	-	0.48 ±0.06	-
A	-	-	4.3 ±0.6
S_{max}	0.19 ±0.01	0.208 ±0.006	0.203 ±0.006
Reduced R^2	0.980	0.999	0.997
Reduced χ^2	1.562	0.033	0.295