Electronic Supplementary Material (ESI) for Analyst

Supporting Informations

Switchable "On-Off-On" Electrochemical Technique for Direct Detection of Survivin mRNA in living Cells

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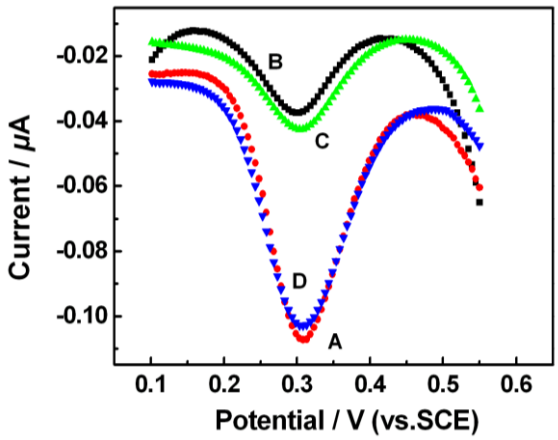

Fig. S1 DPVs from electrode in 10 mM PBS (pH 7.4) modified with Fc-DNA (A), DNA duplex (B), DNA duplex after treatment with Triton X-100 (C) and after further treatment with high temperature to destroy DNA double helix structure (D).

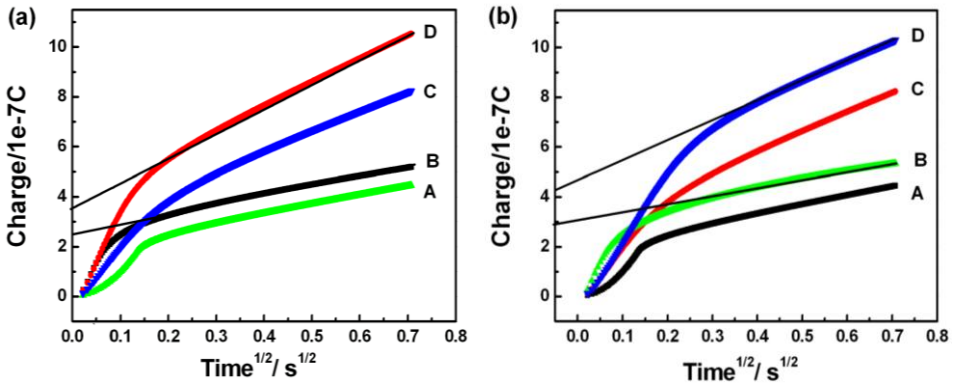

Fig. S2 (a) Chronocoulometric response curves for MCH (A, C) and Probe DNA/MCH (B, D) modified electrdes in the absence (A, B) and presence (C, D) of 50 μM RuHex. The lines represent the fit to the data used to determine the intercept at t=0 for the Probe DNA/MCH curves.

(b) Chronocoulometric response curves for MCH (A, C) and duplex DNA/MCH (B, D) modified electrdes in the absence (A, B) and presence (C, D) of 50 μM RuHex. The lines represent the fit to the data used to determine the intercept at t=0 for the duplex DNA/MCH curves.

We calculated the surface densities of DNA probes according to the formulas: $\Gamma_{DNA} = \Gamma_o (z/m)(N_A)$; $Q_{(t=0)} = Q_{dl} + nFA\Gamma_o$ (n is the number of electrons per molecule for reduction, F the Faraday constant (C/equiv), A the electrode area (cm^2), Q_{dl} the capacitive charge (C), Γ_o designates the surface excess and represents the amount of redox marker confined near the electrode surface, Γ_{DNA} is the probe surface density in molecules/cm^2, m is the number of bases in the probe DNA, z is the charge of the redox molecule, and N_A is Avogadro's number.), the surface densities of DNA probes and duplex DNA in the biosensor are calculated to be 2.1×10^{12} and 1.7×10^{12} molecules/cm^2 as the concentration of the probe DNA is 1μM.

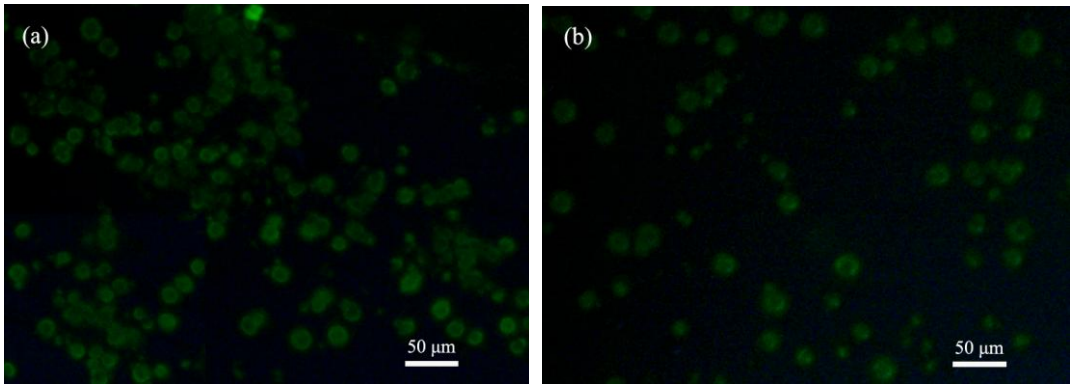

Fig. S3 Photos observed with inverted fluorescence microscope of SMMC-7721 cells cultivated for 6 h transfection by duplex DNA (with FAM) modified gold film with the concentration of the probe DNA 1μM (a) and 0.1 μM (b).

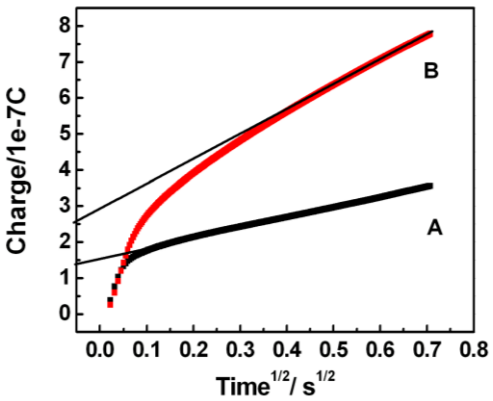

Fig. S4 Chronocoulometric response curves for Probe DNA/MCH modified electrodes in the absence (A) and presence (B) of 50 μM RuHex after 6 h cell transfection (2×10^5 cells/mL SMMC-7721) and cell lysis.

The different responses (charge/C) of Fc-labeled DNA on Au electrode before (Figure. 2S (a)) and after (Figure. 4S) cell transfection and cell lysis were obviously due to the residual DNA duplex on the electrode which were failed to transfect into cells and didn't hybridize with survivin mRNA inside cells. Therefore, according to this difference in response of charge, the final surface density of residual DNA duplex on Au electrode after cell transfection was calculate to be 0.3×10^{12} molecules/cm^2.

And from Figure 2S (b) we have already found the surface density of duplex DNA on the gold electrode before cell transfection to be 1.7×10^{12} molecules/cm^2. Then the total amount of Fc-labeled DNA on Au electrode which successfully transfected into cells could calculate to be $(1.7 \times 10^{12} - 0.3 \times 10^{12})$ molecules/cm^2 = 1.4×10^{12} molecules/cm^2

Then the number of Fc-labeled DNA transfected into each cell could be generally estimated to be 4.7×10^8 molecules.