Supporting Information For

Electrochemical impedance sensor based on small molecule-modified Au electrode for the recognition of a trinucleotide repeat

Hanping He (a,b)*, Xiaoqian Peng (b), Min Huang (b), Xiuhua Zhang (a,b), Gang Chang (a), Shengfu Wang (a,b)

a, Hubei Collaborative Innovation Center for Advanced Organic Chemical Materials, Hubei University, Youyi Road 368, Wuchang, Wuhan, Hubei 430062, (PR China).

b, Ministry of Education Key Laboratory for the Synthesis and Application of Organic Functional Molecules, College of Chemistry and Chemical Engineering, Hubei University, Youyi Road 368, Wuchang, Wuhan, Hubei, 430062, P. R. China

* E-mail: hehanping@hubu.edu.cn.com or changgang@hubu.edu.cn

Tel: +86-027-50865319; Fax: +86-027-88663043

The sequences of nucleotide acids employed were following:

CGG_{10}: 5'-CGG CGG CGG CGG CGG CGG CGG CGG CGG CGG-3'

TGG_{10}: 5'-TGG TGG TGG TGG TGG TGG TGG TGG TGG TGG-3'

CCG_{10}: 5'-CCG CCG CCG CCG CCG CCG CCG CCG CCG CCG-3'

GAA_{10}: 5'-GAA GAA GAA GAA GAA GAA GAA GAA GAA GAA-3'

CAG_{10}: 5'- CAG CAG CAG CAG CAG CAG CAG CAG CAG CAG-3'

CTG_{10}: 5'- CTG CTG CTG CTG CTG CTG CTG CTG CTG CTG-3'

ATT_{10}: 5'- ATT ATT ATT ATT ATT ATT ATT ATT ATT ATT-3'

Synthesis of NCD-linker

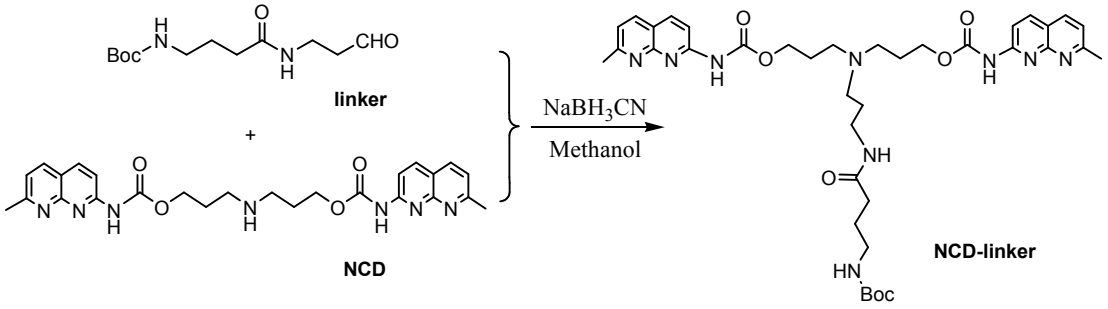

Fig S1. Synthesis of NCD-linker

NCD-linker: ^{1}H NMR($CDCl_3$, 400 MHz) δ: 8.25 (d, 2H, J=8.8 Hz), 8.12 (d, 2H, J=9.2 Hz), 7.98 (d, 2H, J=8.0 Hz), 7.24 (d, 2H, J=8.0 Hz), 4.29(t, 4H, J=6.4 Hz), 3.32 (t, 2H, J=6.4 Hz), 3.18 (t, 2H, J=6.4 Hz), 2.73 (s, 6H), 2.55(t, 4H, J=6.8 Hz), 2.49 (t, 2H, J=6.4 Hz), 2.24 (t, 2H, J=7.2 Hz), 1.87 (m, 6H), 1.70(t, 2H, J=6.8 Hz), 1.40 (s, 9H). ESI-MS, [M^+] calcd for $C_{38}H_{51}N_9O_7$, 745.39; found, 745.50. HRMS, [$(M+H)^+$] calcd for $C_{38}H_{51}N_9O_7$, 746.3990; found, 746.3984, [$(M+Na)^+$] calcd for $C_{38}H_{51}N_9O_7Na$, 768.3809; found, 768.3802.

The definition of ΔR_{ct}

The more intuitive, useful results were provided by the changes in R_{ct}, which were calculated as follows: $\Delta R_{ct} = R_{ct,\ after} - R_{ct,\ before}$

Where $R_{ct,\ before}$ was the R_{ct} of the NCD/MPA/Au sensor before incubation with DNA, and $R_{ct,after}$ was the R_{ct} after incubation with DNA.

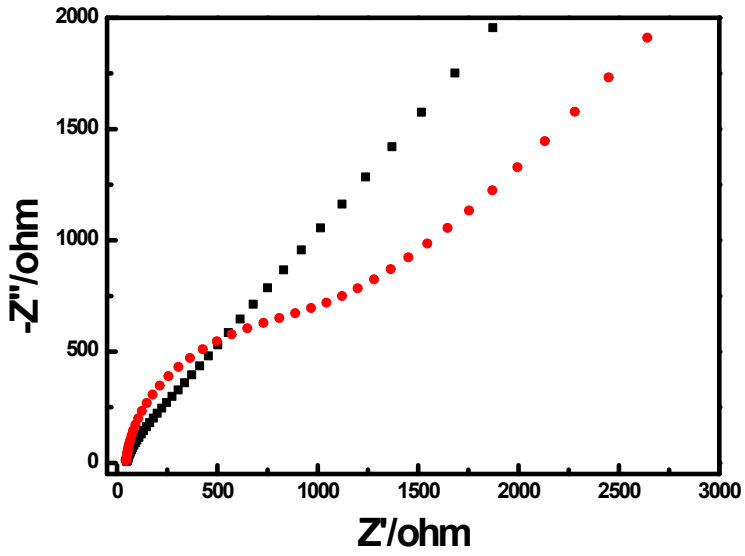

Fig S2. The Nyquist plots of impedance spectra of the bare Au before (black) and after (red) incubation with CGG repeats.

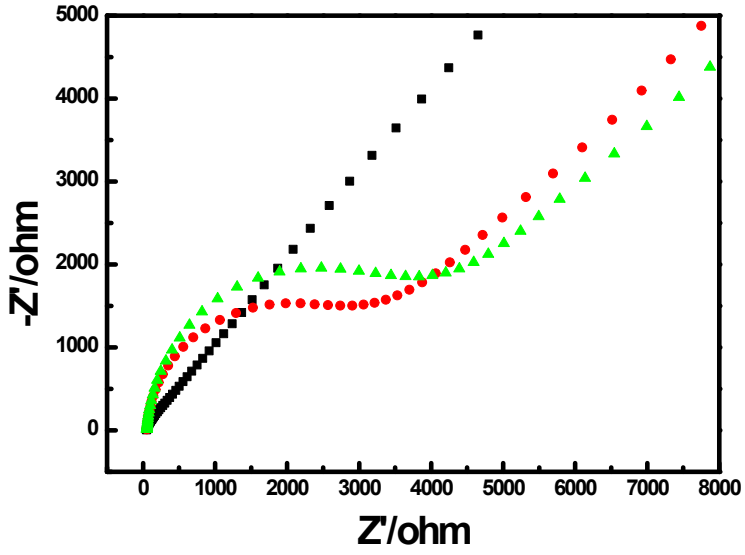

Fig. S3. The Nyquist plots of impedance spectra of the bare Au (black), MPA/Au before (red) and after (green) incubation with CGG repeats.

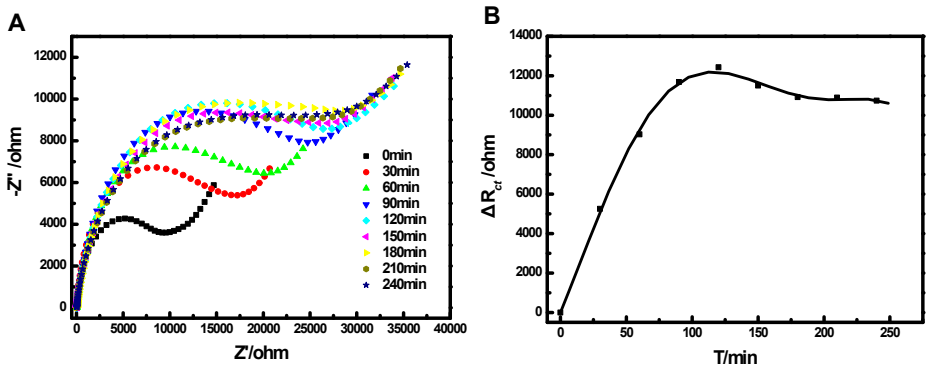

Figure S4. (A) Nyquist plots of impedance spectra of the NCD/MPA/Au biosensor after incubation with CGG_{10} for different times in 10 mM PBS (pH = 7.4). (B) The R_{ct} change values of the NCD/MPA/Au biosensor with different incubation times ($R^2 = 0.9985$).

Table S1 Values of the equivalent circuit parameters of the fitting curves for the different stages of the CGG/NCD/MPA/Au biosensor preparation

	R_s(ohm)	CPE(F)	R_{ct}(ohm)	Z_w(S · sec^5)
bare Au	44.41	6.1095E-6	926	2.3662E-7
MPA/Au	39.77	1.2405E-6	2288	2.3689E-7
NCD/MPA/Au	38.03	1.3515E-6	6089	1.5672E-7
CGG/NCD/MPA/Au	39.17	1.3642E-6	11035	1.2394E-7

Table S2. Parameters of the Cyclic Voltammetry curves for the different stages of the CGG/NCD/MPA/Au sensor

	E_{pa}	I_{pa}	E_{pc}	I_{pc}
bare Au	0.250	7.282E-06	0.185	-7.016E-06
MPA/Au	0.250	6.884E-06	0.159	-6.075E-06
NCD/MPA/Au	0.273	6.401E-06	0.139	-5.845E-06
CGG/NCD/MPA/Au	0.296	5.498E-06	0.119	-4.640E-06

Table S3. Values of the Square Wave Voltammetry curves for the different stages of the CGG/NCD/MPA/Au biosensor preparation

	E_{pa}	I_{pa}
bare Au	0.208	1.496E-05
MPA/Au	0.208	1.112E-05
NCD/MPA/Au	0.220	6.518E-06
CGG/NCD/MPA/Au	0.236	4.361E-06

Table S4. Values of the equivalent circuit parameters of the fitting curves for the different DNAs

Sequence	R_s(ohm)	CPE(F)	R_{ct}(ohm)	Z_w(S · sec^5)	ΔR_{ct}(ohm)
No DNAs	53.94	1.7712E-6	6309	2.2345E-7	-
$(CGG)_{10}$	39.17	1.3642E-6	11336	4.9599E-8	5027
$(TGG)_{10}$	36.99	1.8826 E-6	10882	1.5557	4573
$(CCG)_{10}$	40.44	1.8096 E-6	7730	2.2710	1421
$(GAA)_{10}$	48.02	2.2283 E-6	7581	2.8700	1272
$(CAG)_{10}$	41.21	1.8790 E-6	7331	1.0211	1022
$(CTG)_{10}$	39.43	1.4249 E-6	7380	4.1540	1071
$(ATT)_{10}$	46.82	2.5527 E-6	7795	1.5756	1486