Supporting Information

Stem-Loop DNA-Assisted Silicon Nanowires-Based Biochemical Sensors with Ultrahigh Sensitivity, Specificity, and Multiplexing Capability

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Figure S1 shows fluorescence spectra of noncomplementary DNA and complementary target DNA with serial concentrations.
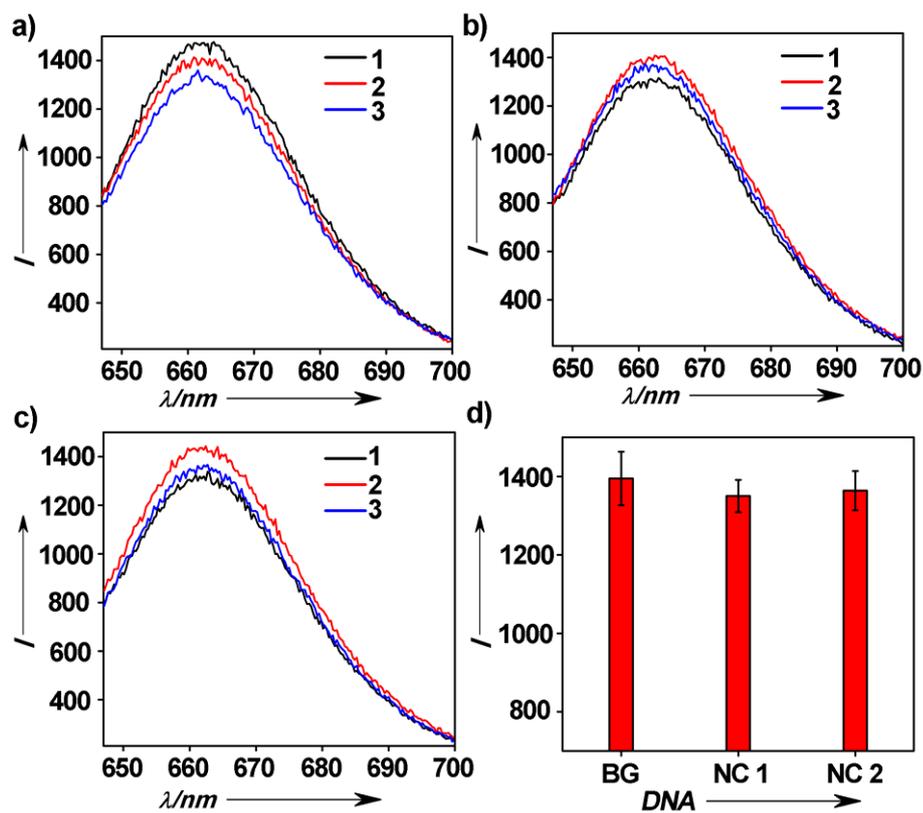
Figure S2 shows fluorescence spectra and corresponding PL intensities of noncomplementary DNA with different sequences.

Table S1 presents oligonucleotide sequences for DNA detection in the experiment.

Table S2 presents oligonucleotides sequences for multi-detection of three types of tumor-suppressor genes (p16, p21, and p53) and MSO probe for Hg^{2+}.
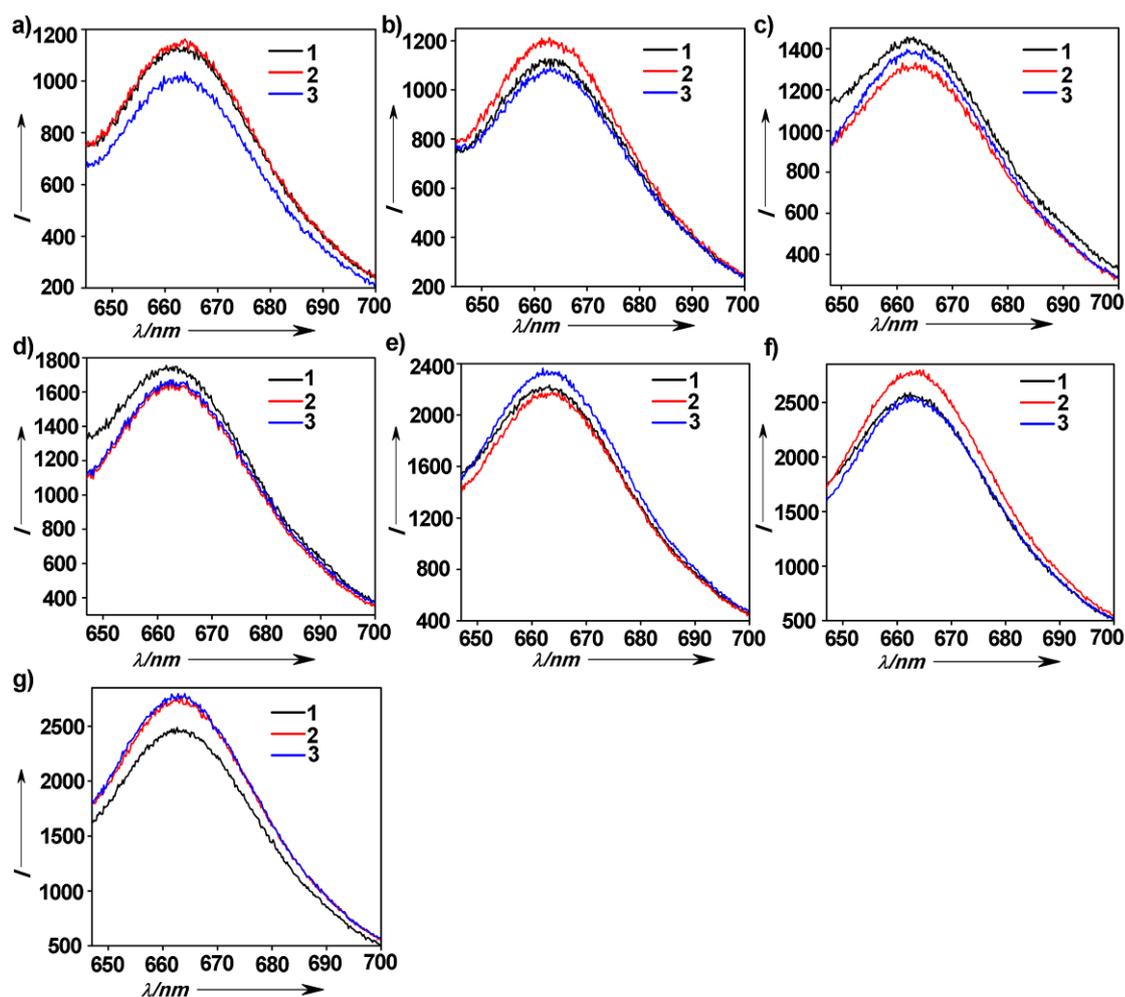
Figure S1. Fluorescence spectra of complementary target DNA with serial concentrations. Background and noncomplementary sequence are presented as controls. (a) Background, after reaction with (b) noncomplementary target DNA, (c) 1 pM target DNA, (d) 10 pM target DNA, (e) 100 pM target DNA, (f) 1 nM target DNA, and (g) 10 nM target DNA. Numbers 1, 2, and 3 stand for repetition times.

Figure S2. Fluorescence spectra (a) in presence of noncomplementary sequence 1 and (b) noncomplementary sequence 2, and (c) in absence of DNA (background). (d) Corresponding PL intensities. Numbers 1, 2, and 3 stand for repetition times.

Table S1. Oligonucleotide sequences for DNA detection in the experiment.

Oligonucleotides	Sequences
Stem-loop DNA probe	5-Cy5-<u>CGCTC</u>[a] CCT TAT TAT TAT TCC <u>GAGCG</u>[a]-T10[b]-$(CH_2)_6$-NH_2-3
Target DNA 1 (perfectly matched)	5-GGA ATA ATA ATA AGG-3
Target DNA 2 (single-base mismatched)	5-GGA ATA AC*c*A ATA AGG-3
Noncomplementary DNA 1	5-TGA GTG GAC GTC AAC GAG CAA-3
Noncomplementary DNA 2	5-CAT GAG GAC GAC GTT-3

[a]Underlined letters represents the stem sequence; [b]T10 represents 10 Ts that serve as the spacer; [c] Italics letter represents the mismatched site.

It is worthwhile to point out that, based on the above listed oligonucleotide sequences, we deduce that the shortest and longest distance between organic dye molecule and SiNW surface for detecting the targets are 3.4 and 11.6 nm, respectively. Typically, in the absence of target DNA, the distance between the organic dye molecule and SiNW surface equals to the length of 10 base pairs (bp), i.e., 10×0.34 nm = 3.4 nm (the length of each base pair is known as 0.34 nm). The distance distinctly increases to 11.6 nm when the stem-loop DNA hybridizes with target DNA, since the stem-loop configuratoin is disrupted and converted into a rigid linear DNA duplex (i.e., 34×0.34 nm = 11.6 nm). Consequently, the distance range between the organic dye molecule and SiNW surface is calculated as 3.4-11.6 nm.

Table S2. Oligonucleotides sequences for multi-detection of three types of tumor-suppressor genes (p16, p21, and p53) and MSO probe for Hg^{2+}.

Oligonucleotides	Sequences
Stem-loop DNA probe A (p16)	5-FAM-CGCTC[a] CAG AGG CAG TAA CCA GAGCG[a]-T10[b]-$(CH_2)_6$-NH_2-3
Target DNA A (p16 gene segment)	5-TGG TTA CTG CCT CTG-3
Target DNA A' (single-base mismatch)	5-TGG TT A CC^cG CCT CTG-3
Stem-loop DNA probe B (p21)	5-Cy5-CGCTC[a] CCC TAA TCC GCC CAC GAGCG[a]-T10[b]-$(CH_2)_6$-NH_2-3
Target DNA B (p21 gene segment)	5-GTG GGC GGA TTA GGG-3
Target DNA B' (single-base mismatch)	5-GTG GGC GT^cA TTA GGG-3
Stem-loop DNA probe C (p53)	5-ROX-CGCTC[a] CCT GGT GCC GTA GAT GAGCG[a]-T10[b]-$(CH_2)_6$-NH_2-3
Target DNA C (p53 gene segment)	5-ATC TAC GGC ACC AGG-3
Target DNA C' (single-base mismatchd)	5-ATC TAC GC^{c}C ACC AGG-3
MSO probe for Hg^{2+}	5-Cy5-TTC TTT CTT CCC CTT GTT TGTT-$(CH_2)_6$-NH_2-3
A control DNA (without T-T pairs) for Hg^{2+}	5-Cy5-AAC AAA CAA CCC CAA GAA AGAA-$(CH_2)_6$-NH_2-3

[a]Underlined letters represents the stem sequence; [b]T10 represents 10 Ts that serve as the spacer; [c] Italics letter represents the mismatched