Supporting Online Material for

Programmed Assembly of DNA-Coated Nanowire Devices

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Published 16 January 2009, *Science* **323**, 352 (2009)
DOI: 10.1126/science.1165921

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Programmed assembly of DNA-coated nanowire arrays

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Materials and Methods

Nanowire Synthesis and Biofunctionalization. Rh nanowires (295 ± 20 nm) were synthesized, coated with ~20 nm SiO_2, and functionalized with DNA probes as previously described (*1, 2*). DNA-coated nanowires (~$1x10^9$ wires in 1 mL 300 mM NaCl, 10 mM phosphate buffer, pH 7.4) were then rinsed by centrifugation/resuspension 3× with 50 μL deionized water, and 3× with ethanol, finally resuspending each sample to 50 μL in ethanol.

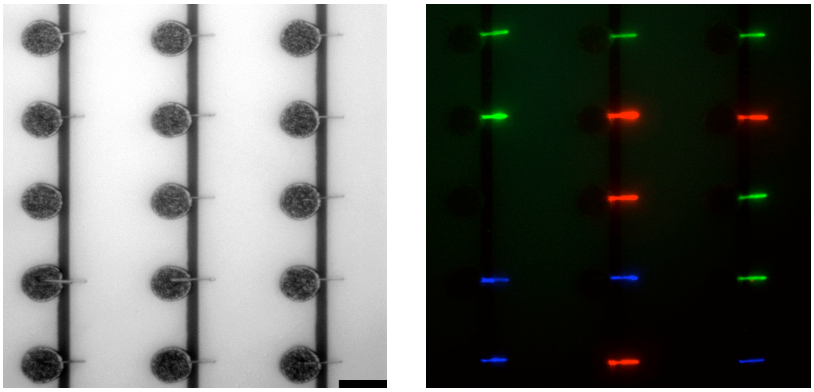
Modeling. FEMLAB software was used to simulate the dielectrophoretic force distribution of four electrode strips embedded in the photoresist layer and the aqueous solution. The gradient of the square root of the electric field ($\nabla|E|2$) represents a measure of dielectrophoretic force exerted on the polarized nanowires.

Lithography and Electrofluidic Assembly. Lithographically defined electrodes (32 μm wide, 5 mm long and separated by a 3 μm gap) were fabricated by metal liftoff of 10 nm Ti, and 90 nm Au on 1 μm thermally grown SiO_2 on a silicon(100) substrate. Microwells (3 x 11 μm, 20 μm pitch) were patterned ~250 nm into 1.0 μm PMGI SF-11 photoresist using previously described methods (*1*). Electrofluidic alignment of DNA functionalized nanowires was accomplished by applying an AC electric field (3 V_{rms}, 1 MHz). Nanowires functionalized with P1, P2 or P3 (Supporting Table 1), were further diluted (300-fold) with ethanol, and deposited on the substrate and positioned into the left, right, and middle microwell columns respectively, allowing the ethanol to evaporate after each set nanowires was assembled.

Following nanowire assembly Au contacts were fabricated as previously described (*1*). Orotemp 24 RTU was electrodeposited for 15 min at -2.51 V vs Pt gauze in a two electrode system forming the Au contacts. The photoresist layers were removed by submerging the wafer in Microposit 1165 remover (15 min, 50^O C), then rinsed by submerging the wafer in deionized H_2O, and isopropanol and allowed to air dry.

DNA hybridization and imaging. Non-specific binding to the chip was reduced by functionalizing exposed surfaces with a 5' thiolated 10 C sequence for one hour. Hybridization of T1, T2 and T3 to their respective DNA probe molecules was performed at 0.38 μM T1, T2,

and T3 in PBS at room temperature for ~36 hours, after which wafers were rinsed in PBS and a coverslip added for imaging (1.4 NA, 60x objective). Fluorescence images were acquired sequentially at each chip location, and were false-colored and overlaid for viewing (Alexa488 = blue, Alexa647 = red, and TAMRA = green).



Supporting Figure 1. Control in which DNA-coated nanowire populations were mixed prior to assembly onto the chip. Wires carrying different probe sequences are randomly distributed between the columns of microwells. Scale bar = 10 μm.

Supporting Table 1

Name	Sequence 5'→3'	Description
P1	Thiol- TTTTTTTTTTGAGTAGTGTTGGGTCGCGAA	HCV[a] Probe
P2	Thiol- TTTTTTTTTTCCATCAATGAGGAAGCTGCA	HIV[b] Probe
P3	Thiol-TTTTTTTTTTCTCAATCTCGGGAATCTCAA	HBV[c] Probe
T1	Alexa Fluor 488- TTCGCGACCCAACACTACTC	HCV Target
T2	Alexa Fluor 647-TGCAGCTTCCTCATTGATGG	HIV Target
T3	Tamra-TTGAGATTCCCGAGATTGAG	HBV Target

[a] HCV = hepatitis C virus; [b] HIV = human immunodeficiency virus, [c] HBV = hepatitis B virus.

References

(1) M. Li et al. *Nature Nanotechnol*. **3**, 88 (2008).

(2) J. Sioss et al. *Langmuir* **23**, 11334 (2007).