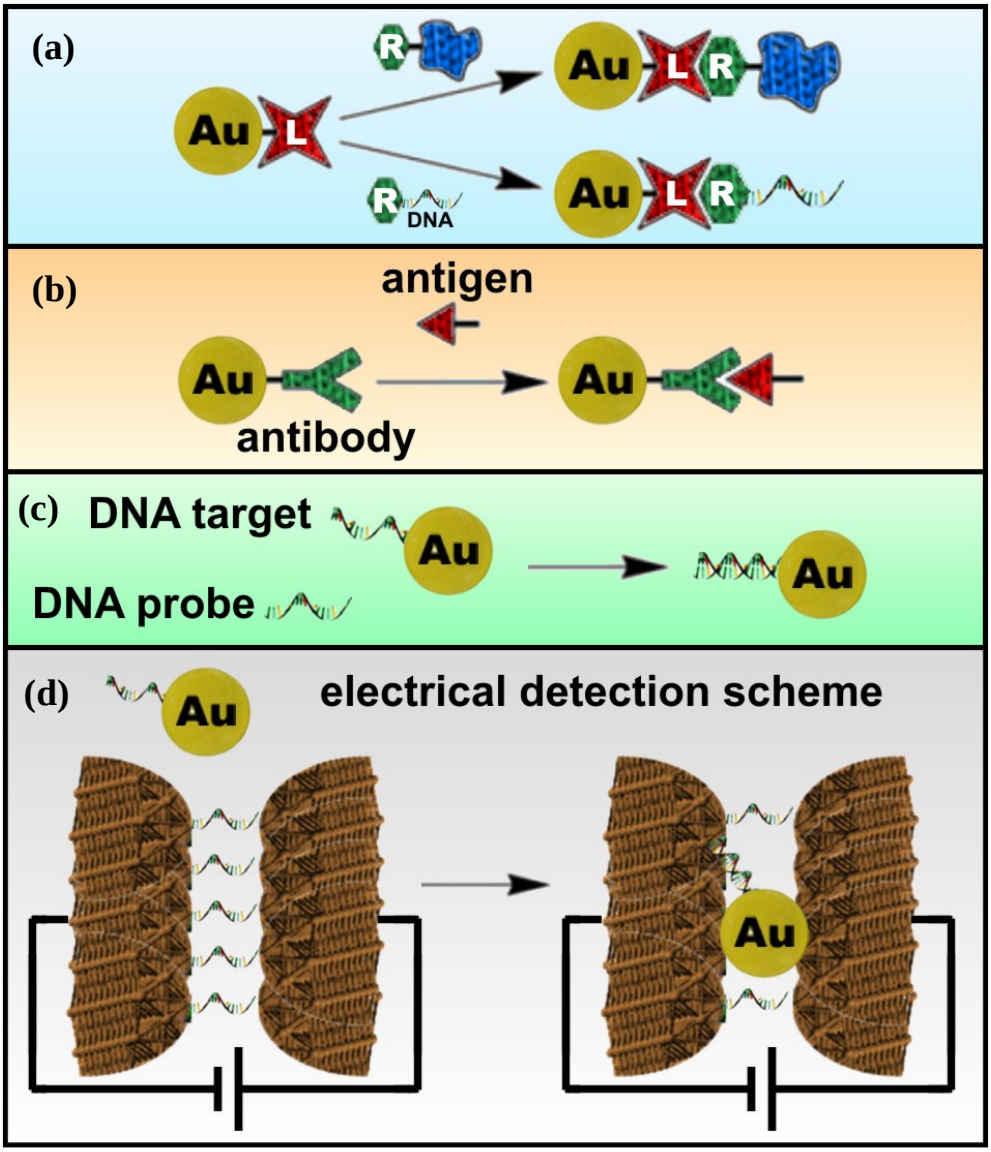
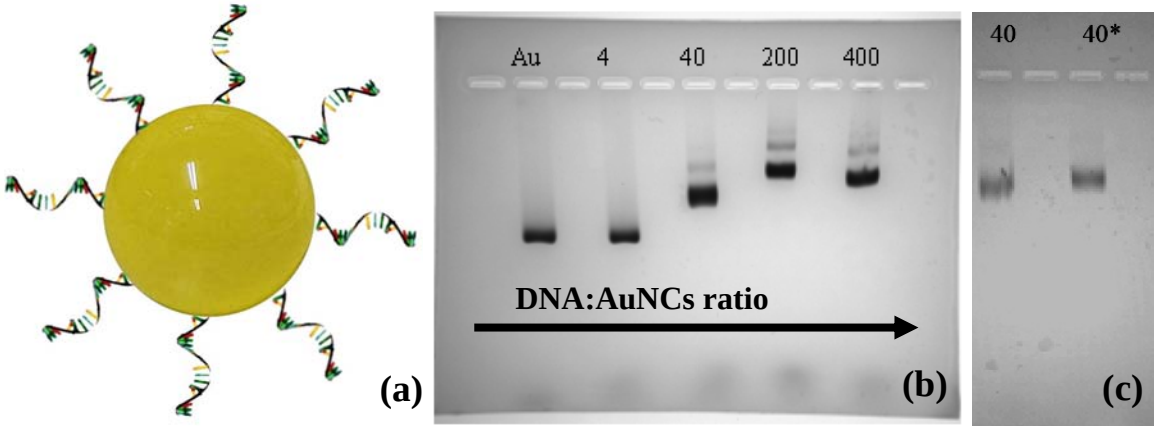
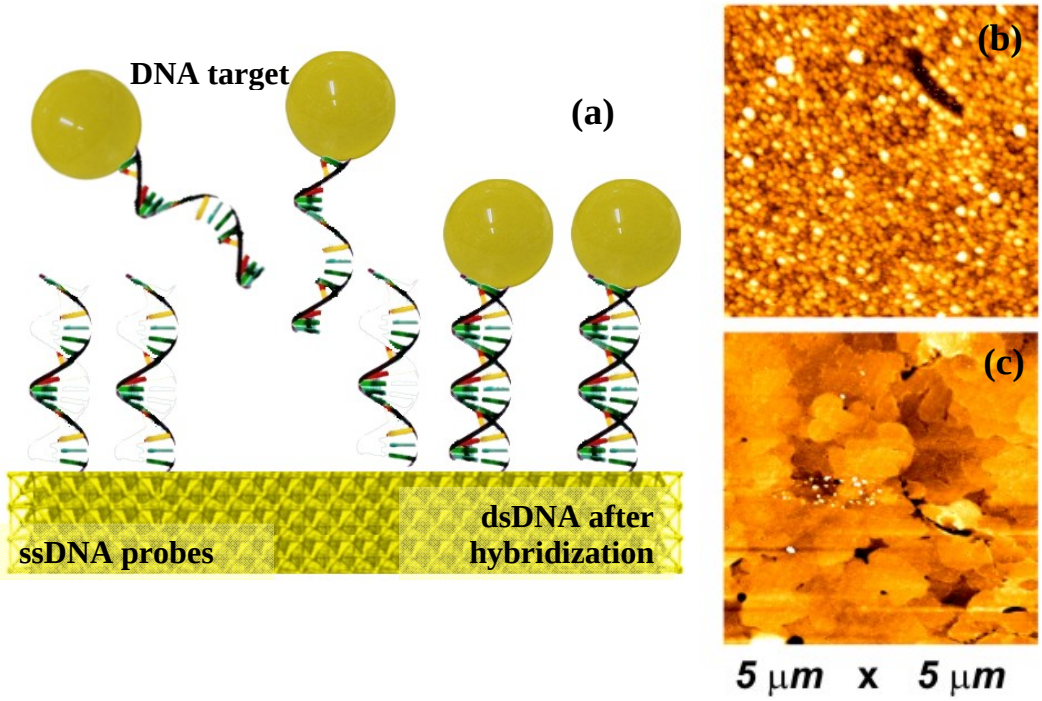
SUPPLEMENTARY MATERIALS



Additional Figure 1. Detection strategy. Proposed detection scheme for electrical transduction at the nanoscale. **(a-c)** Applications involving biorecognition events between a) ligand-receptors, b) antibodies-antigens and c) DNA hybridization that are detectable as an increase in the conduction of a nanojunction due to **(d)** the formation of a conductive bridge between two electrodes via the AuNC.



Additional Figure 2. AuNC-DNA conjugates. (a) AuNC-DNA conjugates prepared by addition of 5'-SH-ssDNA to a AuNC solution. **(b)** Gel electrophoresis characterization on 2% agarose gel at 100 V run for 1 hour. AuNCs and some AuNC-DNA conjugates having different DNA-AuNC molar ratios, increasing from left (4:1) to right (400:1) were loaded. The AuNCs concentration was constant to 0.05 μM. We observed a saturation mobility for molar ratios higher than 200, meaning that in these cases the surface of the AuNCs is already completely covered with DNA. Second bands of lower mobility for samples 40, 200, and 400 are likely due to byproducts of the DNA-AuNC reaction which favours in these reaction conditions the formation of conjugates of bigger sizes. **(c)** 2% agarose gel loaded with 40:1 DNA:AuNCs solutions left to react 18 h and 42 h (labeled 40 and 40* respectively). Since we observe similar mobility, we conclude that no unreacted oligonucleosides remain in solutions after 18h.



Additional Figure 3. Hybridization tests. (a) Schematic representation of ssDNA-target hybridization to ssDNA capture probes immobilized on a gold surface/electrode (2-mercaptoethanol molecules between ssDNA are not shown for clarity). **(b-c)** Tapping mode AFM images of the funzionalized surface after reaction with conjugates having **(b)** a complementary ssDNA or **(c)** a two bases mismatch. In both cases the hybridization was carried out by incubating the surface functionalized with mixed self assembled monolayers of capture probes and 2-mercaptoethanol for 6h in a 10:1 DNA:AuNCs solution 0.25nM in PBS (0.1M NaCl). While an high coverage is observed in the case of perfectly matching oligonucleotides sequences, in the presence of a two-bases mismatch only the gold terraces are visible.