Supporting Information for:

**A proof of concept application of aptachain: ligand-induced self-assembly of a DNA aptamer**

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Fig. S1. Schematic outlining the formation of aptachain with the oligos AC3 and AC4. The parent cocaine-binding aptamer is split into two overlapping strands that associate in the presence of ligand. Dashed lines indicate Watson-Crick base pairs and dots indicate non-Watson-Crick base pairs.
**Fig. S2.** ITC data showing the interaction of (a) quinine with a 1:1 molar ratio mixture of the MS3 and OR6 DNA strands and (b) the interaction of the MS3 and OR6 strands. On top is the raw titration data showing the heat resulting from each injection of the titration. The bottom shows the integrated heat plot after correcting for the heat of dilution. These data provide a $K_d$ value of $(16 \pm 2) \mu$M for the AC3/AC4 combination binding quinine and a $K_d$ value of $(3.1 \pm 0.2) \mu$M for the two strands interacting. Data for both runs were acquired in 20 mM phosphate (pH 7.4), 140 mM NaCl, 5 mM KCl at 15 °C.
Fig. S3. Size exclusion chromatograms of (A) MS3; (B) OR6; (C) MN4 oligos. (D) Size exclusion calibration curve to extrapolate the approximate molecular weights of aptachain based on the retention times. Blue points are the data points of known DNA oligos and the orange points are the extrapolated MWs based on experimentally determined retention times. $t_R$ is the retention time, $t_{Vo}$ is the void time (time to elute void volume; 240 min).
**Fig. S4.** Addition of 250 µM quinine to the 0 µM quinine control used for the 12h time trial. This figure shows that under the “gentle annealing” conditions used for the AuNP modified OR6 that the aptachain does not assemble in the absence of its ligand for 12 hours and that the sample is still active as the peak wavelength changes upon addition of quinine. Note that the maximum absorbance decreases with the addition of quinine due to dilution of the sample.
Fig. S5. Traces of absorbance versus time of AuNP functionalized aptachain formation with the addition of 0 µM, 5 µM and 50 µM quinine. The traces show that if the system is to be used for analytical detection the optimal time to take a measurement is after 2 hours. The signal begins to saturate after 4 hours.