Supplementary Material (ESI) for Chemical Communications

Electronic Supplementary Information

Photonic Boolean logic gates based on DNA aptamers

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Materials and methods

For the AND logic gate, 480 nM **AFT**, 1440 nM **QDNA1** and 1440 nM **QDNA2** were mixed in TKM buffer (20 mM Tris-HCl, 5mM KCl and 0.9 mM $MgCl_2$, pH 8.3) and annealed by heating the solution to 95 ºC for 2 min and slowly cooling down to 4 ºC over 70 min using a thermal cycler (Mastercycler ep, Eppendorf) . Upon completion, appropriate amounts of adenosine (Acros Organics), human α-thrombin (Enzyme Research Laboratories), **ADNA**, or **TDNA** were added and incubated at room temperature for 30 min. Final concentrations: 20 nM **AFT**, 60 nM **QDNA1** and 60 nM **QDNA2**. Fluorescence was measured by a Safire^2 microplate reader (Tecan) with 483 nm excitation and 525 nm emission. The values were normalized to the fluorescence of the solution without any input molecules.

The OR gate was characterized similarly with following DNAs: 480 nM **FDNA**, 1440 nM **AT** and 1920 nM **QDNA2** were mixed and annealed in TKM buffer to yield 20 nM **FDNA**, 60 nM **AT** and 80 nM **QDNA2** in the measured solutions.

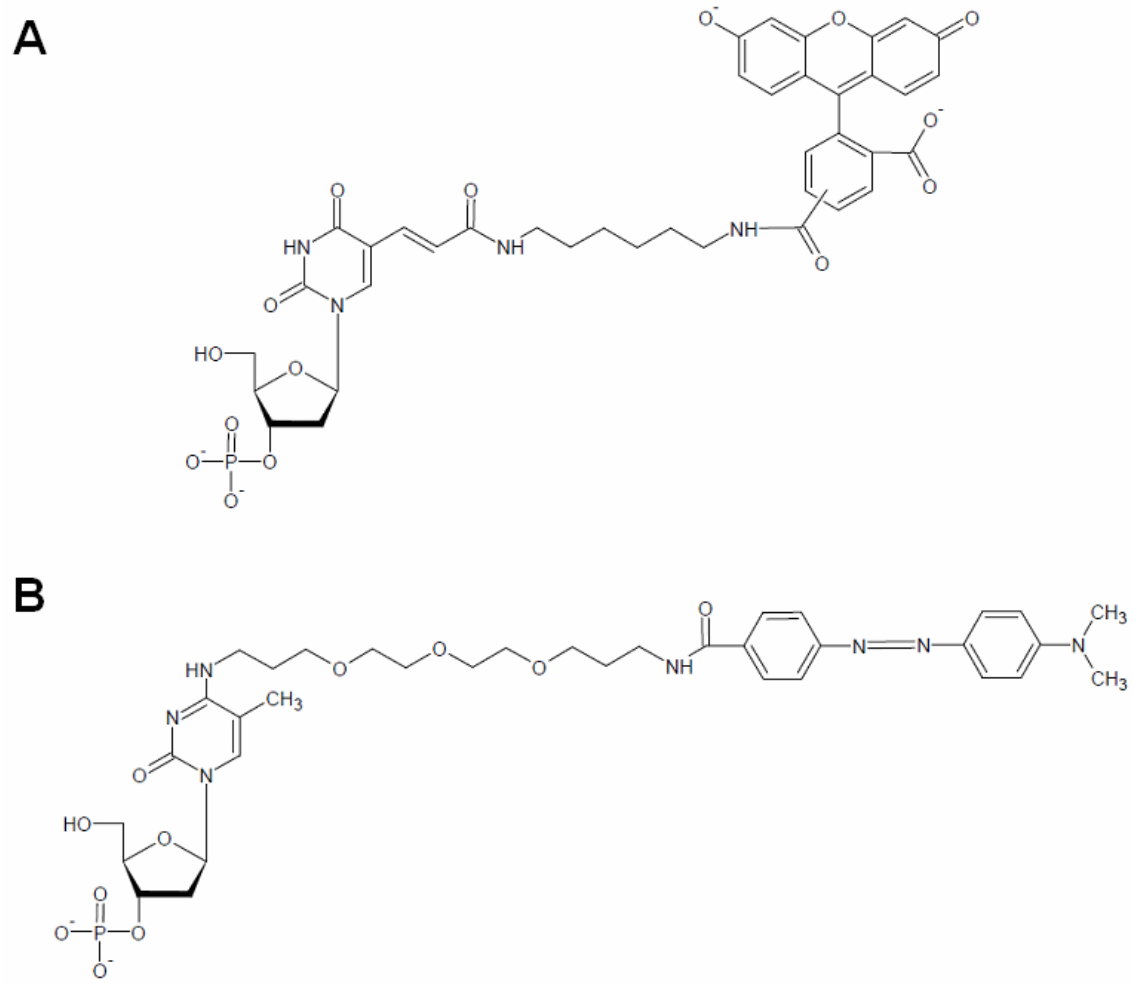

Figure S1. Structures of fluorescein-dT (A) and Dabcyl (B) used in the logic gate DNAs.

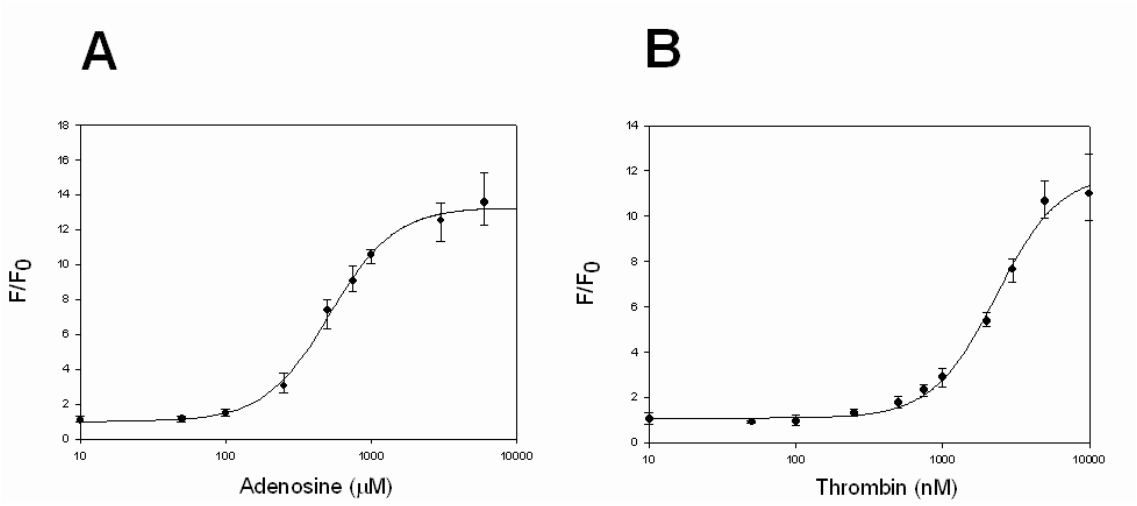

Figure S2. Characterization of individual structure-switching signaling aptamers to adenosine and thrombin. (A) Varying concentrations of adenosine were added to the ternary complex **AFT-QDNA1-TDNA** (**AFT**: 20 nM, **QDNA1**: 60 nM, **TDNA**: 500 nM) and the fluorescence was measured as described above. (B) Varying concentrations of thrombin were added to the ternary complex **AFT-ADNA-QDNA2** (**AFT**: 20 nM, **ADNA**: 500 nM, **QDNA2**: 60 nM) and the fluorescence was measured as described above. Data are averages of three independently prepared solutions. Error bars indicate the maximum and minimum fluorescence values obtained for each concentration. Lines are drawn to guide the eye.