SUPPLEMENTARY INFORMATION

DNA-Based Photonic Logic Gates: AND, NAND and INHIBIT

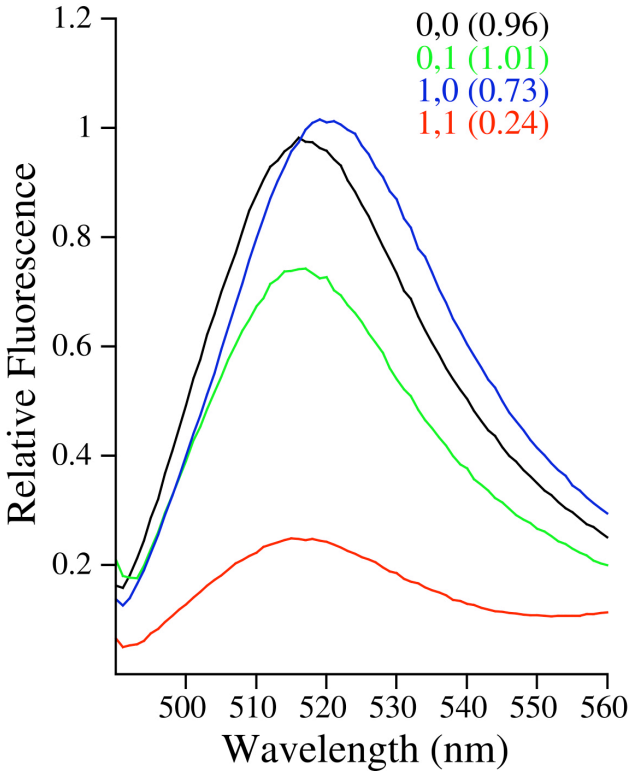
Alan Saghatelian, Nicolas H. Völcker, Kevin M. Guckian, Victor S.-Y. Lin, and M. Reza Ghadiri*

Contribution from the Departments of Chemistry and Molecular Biology and the Skaggs Institute for Chemical Biology, The Scripps Research Institute, La Jolla, California 92037.

General methods.

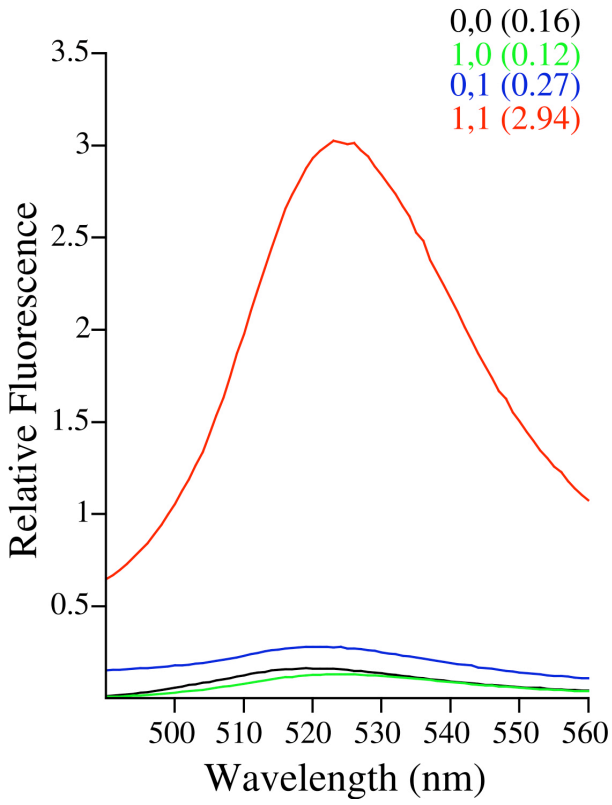
All oligonucleotides were synthesized by the standard phosphoramidite method on an Applied Biosystems 391 DNA synthesizer. The 3'-fluorescein CPG was purchased from Glen Research. Synthesis and deprotection of all modified oligonucleotides were performed as instructed by Glen Research. Oligonucleotides were purified by PAGE electrophoresis, extracted by the crush and soak method, and desalted using C18 Sep-Pak cartridges (Waters). Oligonucleotides were stored frozen at –20 ˚C prior to use and the concentration of stock solutions were determined by UV absorbance using nearest neighbor parameters. Fluorescence emission spectra were taken on an Aminco-Bowman series-2 fluorescence spectrophotometer at room temperature. A typical bandpass of 2 nm was chosen for excitation and emission. Excitation wavelengths were 490 nm for fluorescein and 350 nm for Hoecsht 33342. Emission was scanned from 450 to 700 nm.

AND gate. Four separate Eppendorf tubes corresponding to the four possible states of the AND gate (0,0; 1,0; 0,1; 1,1) were prepared by dilution of stock solutions of the AND gate (final concentration 2 □M), ANDin1 (final concentration 2 □M), and ANDin2 (final concentration 2 □M) in 50 mM Tris, 2 mM $MgCl_2$, pH 8. The contents of each tube were then analyzed individually by excitation at 350 nm and recording the fluorescence emission at 520 nm.



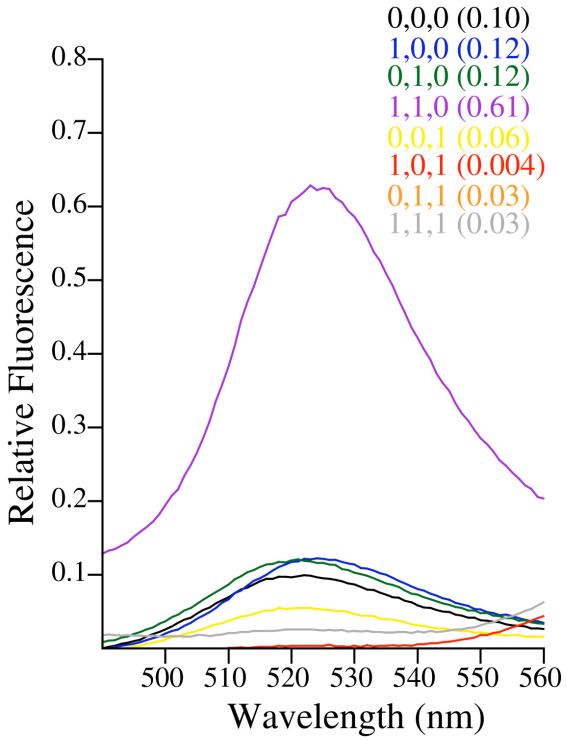
Supplementary Figure 1. AND gate fluorescence at 520 nm with different combinations of the inputs. The figure insert corresponds to the graph based on color. The value in parenthesis is the absolute value of the fluorescence emission at 520 nm.

NAND gate. Four separate Eppendorf tubes corresponding to the four possible states of the NAND gate (0,0; 1,0; 0,1; 1,1) were prepared by dilution of stock solutions of the NAND gate (final concentration 1.5 □M), NANDin1 (final concentration 1.5 □M), and NANDin2 (final concentration 2 □M) in 20 mM Tris, 10 mM KCl, 10 mM $(NH_4)_2SO_4$, 2 mM $MgSO_4$, 0.1% Triton, pH 8.8. The contents of each tube were then analyzed individually by excitation at 490 nm and by recording the fluorescence emission at 520 nm.



Supplementary Figure 2. NAND gate fluorescence at 520 nm with different combinations of the inputs. The figure insert corresponds to the graph based on color. The value in parenthesis is the absolute value of the fluorescence emission at 520 nm.

INHIBIT gate. Eight separate Eppendorf tubes corresponding to the four possible states of the INHIBIT gate (0,0,0; 1,0,0; 0,1,0; 1,1,0; 0,0,1; 1,0,1; 0,1,1; 1,1,1) were prepared by dilution of stock solutions of the INHIBIT gate (final concentration 5 □M), INHin1 (final concentration 10 □M), INHin2 (final concentration 10 □M), and INHin3 (final concentration 250 □M) in 50 mM Tris, 2 mM $MgCl_2$, pH 8. The contents of each tube were then analyzed individually by excitation at 350 nm and recording the fluorescence emission at 520 nm.



Supplementary Figure 3. INHIBIT gate fluorescence at 520 nm with different combinations of the inputs. The figure insert corresponds to the graph based on color. The value in parenthesis is the absolute value of the fluorescence emission at 520 nm.