

Measure the length of DNA using a special calliper made of split G-quadruplex

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Materials

DNA were purchased from Sangon Biotechnology Co., Ltd (Shanghai, China). PPIX was gained from Sigma-Aldrich. Other chemicals were of reagent grade and were used without further purification. The sequence of oligonucleotides used in this work was shown in Table S1. The oligonucleotide was dissolved in water as stock solution and quantified by UV-Vis absorption spectroscopy with the following extinction coefficients ($\epsilon_{260\text{ nm}}$, $\text{M}^{-1}\text{cm}^{-1}$): A = 15400, G = 11500, C = 7400, T = 8700. UV-vis absorbance measurements were performed on a Cary 50 Scan UV/Vis/NIR Spectrophotometer (Varian, USA).

Preparation of DNA-PPIX Complexes

The oligonucleotides were dissolved in water as stock solution and diluted with Tris buffer (10 mM Tris-HCl, 1 mM EDTA, 100 mM NaCl, 20 mM KCl, pH 8.0). The solutions were heated at 88°C for 10 min and slowly cooled down to room temperature. Then freshly prepared PPIX solution with Tris buffer was added into the DNA solution and incubated for 30 min before fluorescent test. The fluorescent analysis was performed in the Tris buffer with a final concentration of 0.4 μM for PPIX, G₁, G₂ and S_x (S_x represents the strand hybridized with G₁ and G₂, like S₀, S₃, S₁₇, etc.).

Fluorescence Spectroscopic Analysis

Fluoromax-4 Spectrofluorometer (HORIBA Jobin Yvon, Inc., NJ, USA) was used to collect the fluorescence emission spectra of DNA-PPIX complexes in Tris buffer under room temperature from 550 to 750 nm with the excitation wavelength of 410 nm.

Circular Dichroism Measurements

CD spectra were measured on a JASCO J-820 spectropolarimeter (Tokyo, Japan) under room temperature. Spectra were recorded from 200 to 320 nm in 1 mm pathlength cuvettes and averaged from three scans.

UV Spectra for DNA-PPIX Complexes

The interactions between PPIX and different DNA group in the Tris buffer were investigated by UV-vis absorption spectroscopy. The absorption spectra were collected with a Cary 50 scan UV-vis-NIR spectrophotometer (Varian) in the wavelength range from 315 to 500 nm.

Table S1 Sequences of the oligonucleotides used in this work. The sequences are coloured in the same way as in figures.

| Name | Sequence |
|------|--|
| G1 | 5'-TGGGT GAGATGTATG-3' |
| G2 | 5'-GACGTAATAG TGGGTAGGGCGGG-3' |
| G3 | 5'-GGGTAGGGT GAGATTGCGG-3' |
| G4 | 5'-GACGTAATAG TGGGTTGGG-3' |
| G5 | 5'-TGGGT GAGATTGCGG-3' |
| S0 | 5'-CATACATCTC CTATTACGTC-3' |
| S1 | 5'-CATACATCTC T CTATTACGTC-3' |
| S3 | 5'-CATACATCTC TTT CTATTACGTC-3' |
| S5 | 5'-CATACATCTC TTGTT CTATTACGTC-3' |
| S7 | 5'-CATACATCTC TTGACTT CTATTACGTC-3' |
| S9 | 5'-CATACATCTC TTTGACTTT CTATTACGTC-3' |
| S13 | 5'-CATACATCTC TTTTGGACTTTT CTATTACGTC-3' |
| S17 | 5'-CATACATCTC AGTTTGGACCTTTTCT CTATTACGTC-3' |
| M1G* | 5'-CATACATGTCCTATTACGTC-3' |
| M1A* | 5'-CATACATATCCTATTACGTC-3' |
| M1T* | 5'-CATACATTCCTATTACGTC-3' |

*The mismatched bases are underlined.

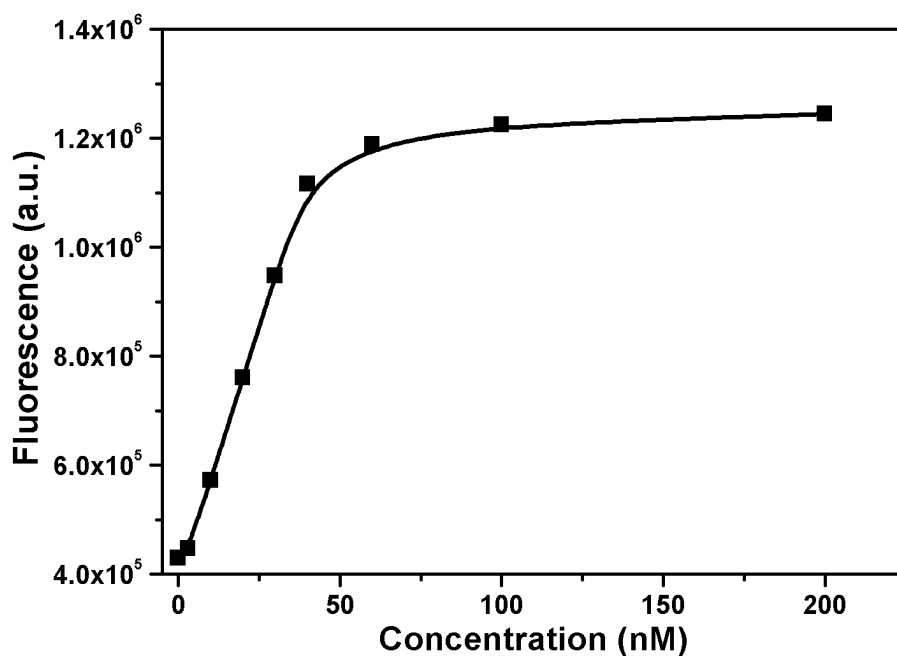


Figure S1 Dependence of the fluorescence intensity of the complexes of PPIX and G₁+G₂+S₀ at 630 nm on the S₀ concentration.

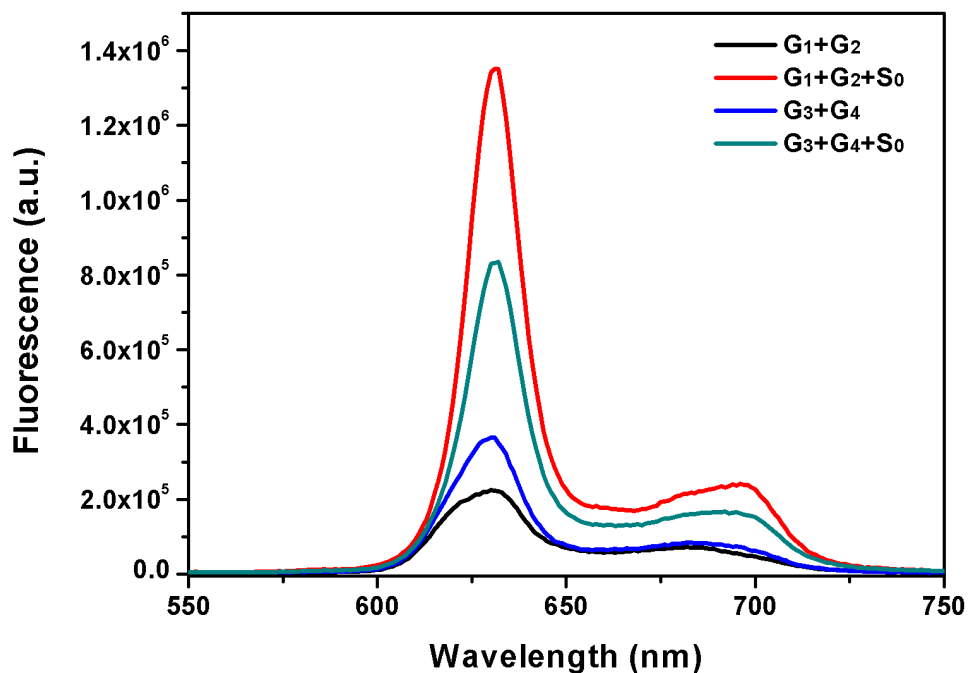


Figure S2 Fluorescence emission spectra of the complexes of PPIX and different DNA strand. G_1 , G_2 are for the 3:1 mode and G_3 , G_4 are for the 2:2 mode. The concentrations of PPIX and DNAs are all $0.4 \mu\text{M}$.

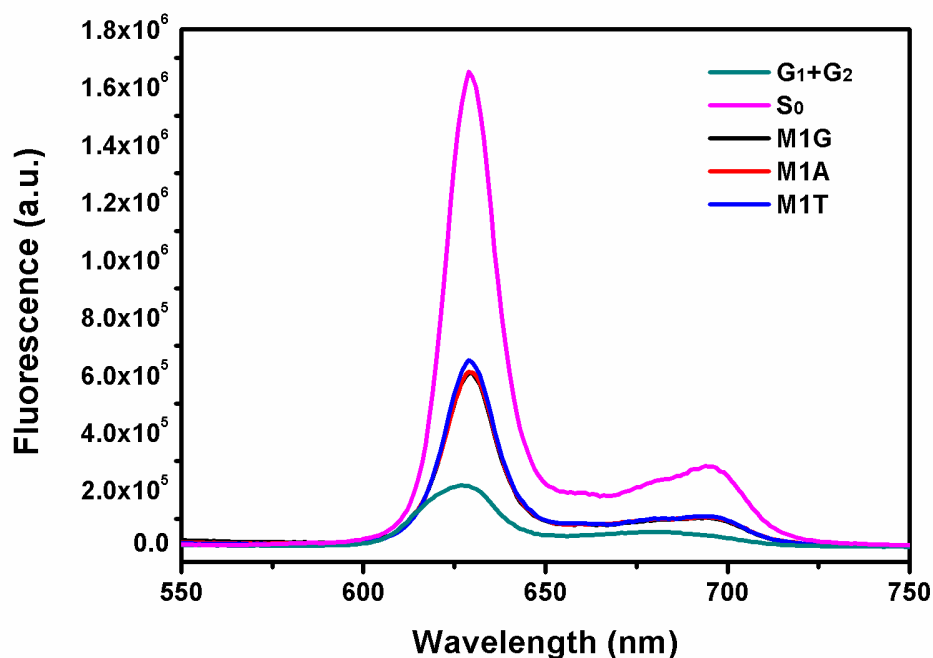


Figure S3 Fluorescence emission spectra of the complexes of PPIX and different DNA strand (from bottom to top) in Tris buffer: G_1+G_2 , G_1+G_2+M1G , G_1+G_2+M1A , G_1+G_2+M1T and $G_1+G_2+S_0$. The concentrations of PPIX and DNAs are all $0.4 \mu\text{M}$.

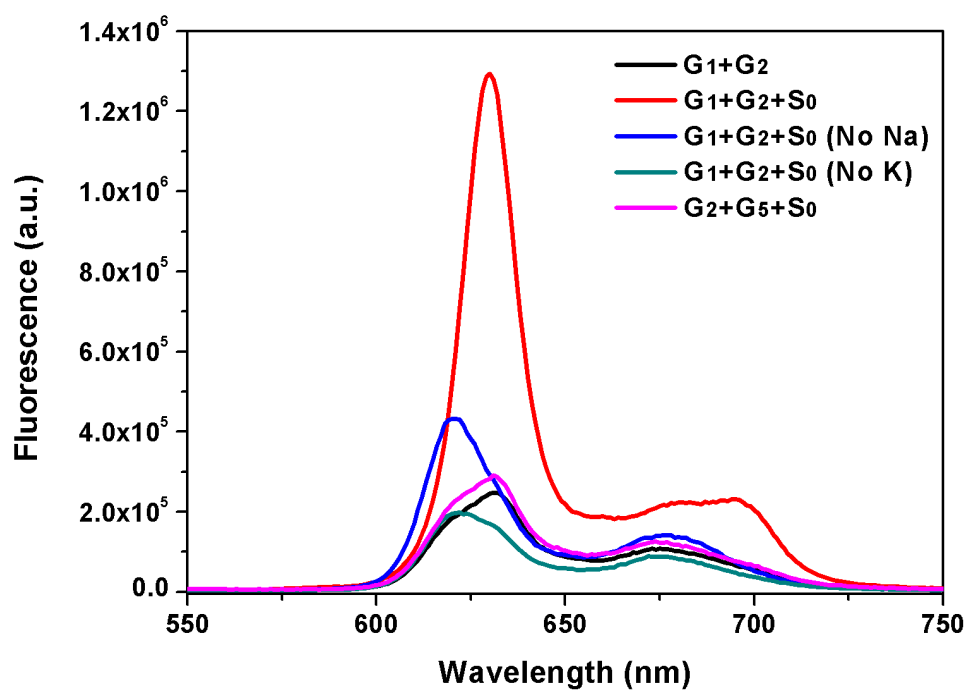


Figure S4 Fluorescence emission spectra of the complexes of PPIX and different DNA strand (from bottom to top): $G_1+G_2+S_0$ in Tris buffer without K^+ , G_1+G_2 in Tris buffer, $G_2+G_5+S_0$ in Tris buffer, $G_1+G_2+S_0$ in Tris buffer without Na^+ and $G_1+G_2+S_0$ in Tris buffer. The concentrations of PPIX and DNAs are all 0.4 μ M.