

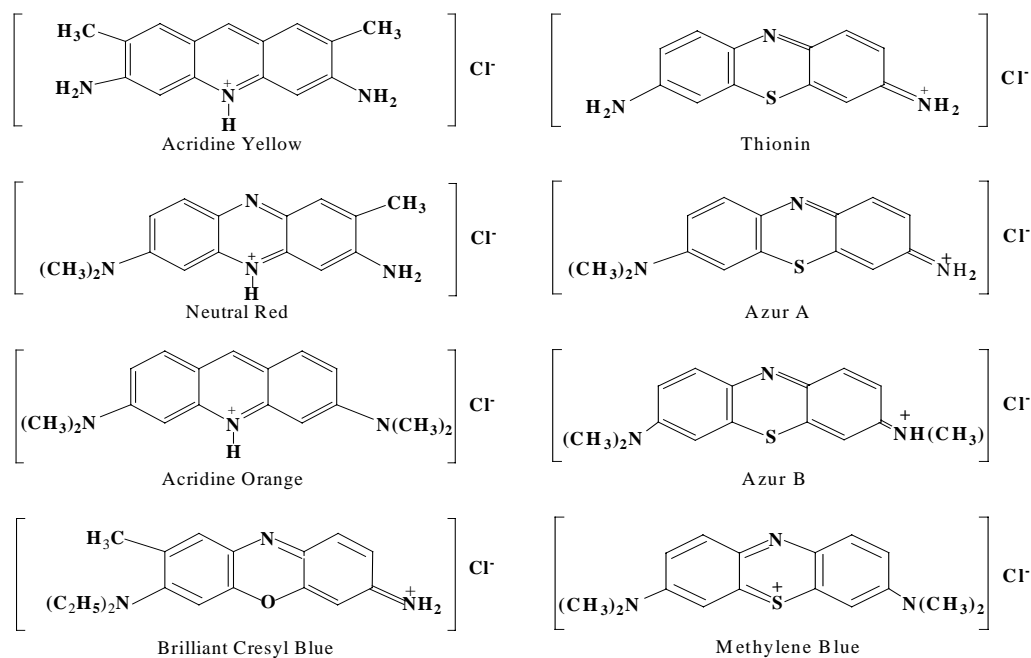
## SUPPORTING INFORMATION

### Hybridization Detection of DNA by Measuring Organic Small Molecules **Amplified** Resonance Light Scattering Signals

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#### 1. Molecular structure of quinone-imine dyes

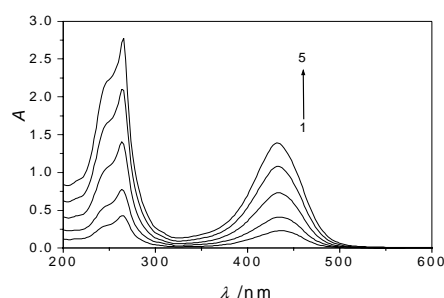


**Figure S1.** The molecular structure of quinone-imine dyes including Acridine Yellow (AY), Neutral Red (NR), Acridine Orange (AO), Brilliant Cresyl Blue (BCB), Thionin (TN), Azur A (AA), and Azur B (AB), and Methylene Blue (MB).

## 2. The optimal condition of the interaction

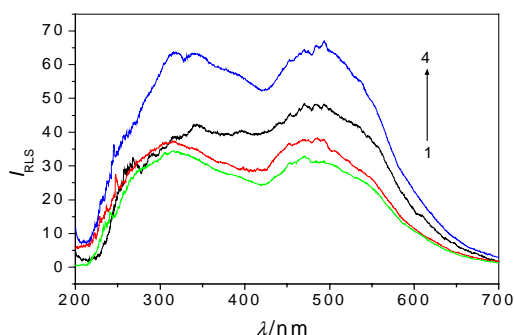
The studies show that the hybridization reaction of P1 and T1 could be completed in 30 mins at the temperature of 37 °C. All measurements were made after P1 and T1 react 30 mins. The effect of dye concentration on  $\Delta I_{\text{RLS}}$  of the system was studied using AY as a representative. When the concentration of AY is  $2.0 \times 10^{-5} \text{ mol l}^{-1}$ , the  $\Delta I_{\text{RLS}}$  of the system reaches maximum.  $2.0 \times 10^{-5} \text{ mol l}^{-1}$  is selected for further research.

## 3. The absorption spectra of the AY



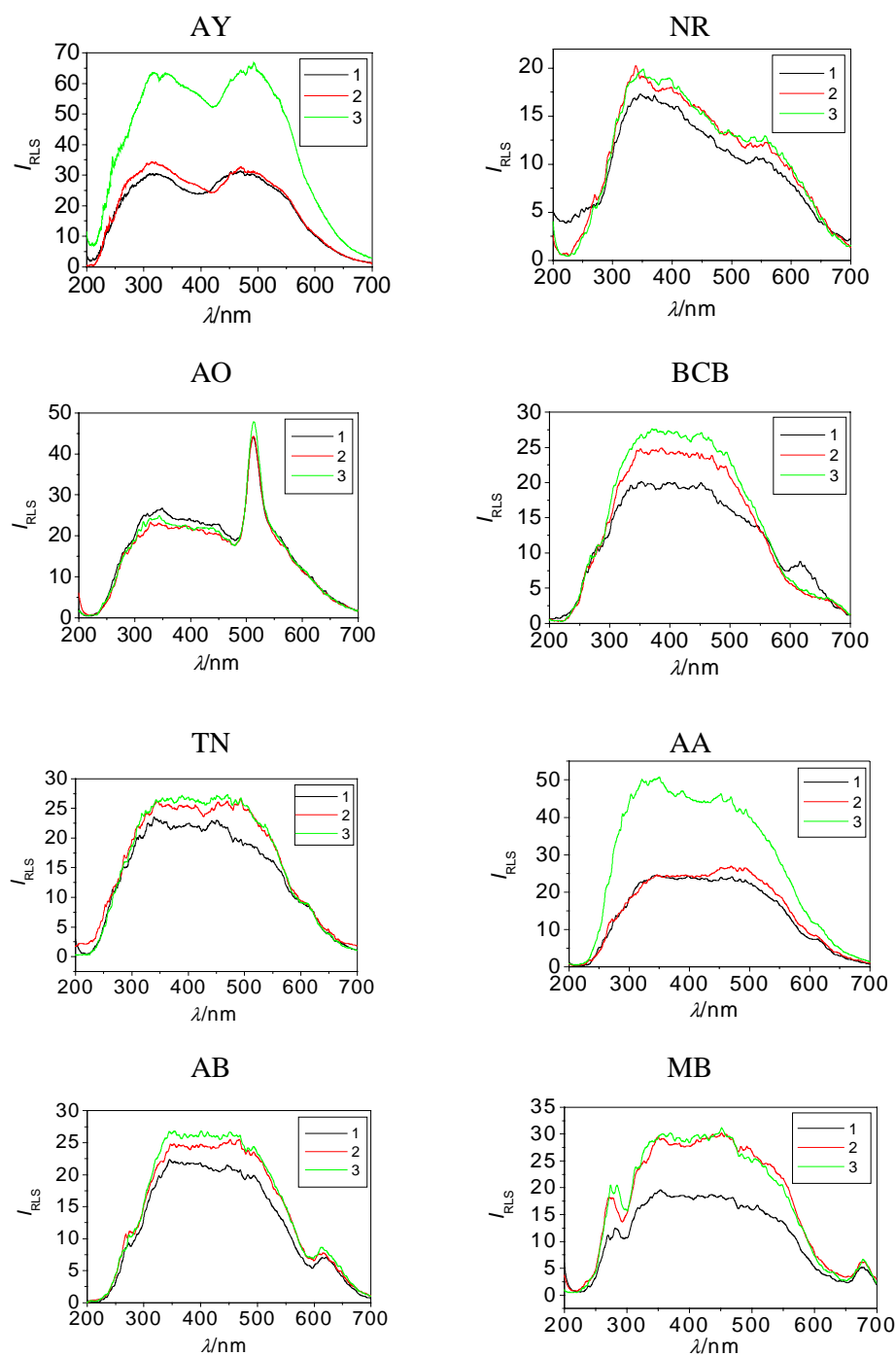
**Figure S2.** The absorption spectra of AY in different concentration.  $c_{\text{AY}} (\times 10^{-5} \text{ M})$ : 1, 1.5; 2, 3.0; 3, 6.0; 4, 10.0; 5, 13.0; pH, 7.20.

## 4. The spectra of sequence selectivity detection



**Figure S3.** The results of sequence selectivity detection. 1, AY-P1 (green); 2, P1-fsDNA-AY (red); 3, P1-MT1-AY (black); 4, P1-T1-AY (blue).  $c_{\text{AY}}, 2.0 \times 10^{-5} \text{ M}$ ;  $c_{\text{P1}}, c_{\text{T1}}, c_{\text{fsDNA}}$  and  $c_{\text{MT}}, 1.0 \times 10^{-7} \text{ M}$ ; pH, 7.2.

## 5. The RLS spectra of the interaction of P1 and P1≈T1 with quinone-imine dyes



**Figure S4.** RLS spectra properties of the interaction of P1 and P1≈T1 with AY, NR, AO, BCB, TN, AA, AB, and MB (OSMs). 1: OSMs (black); 2: P1-OSMs (red); 3: P1≈T1-OSMs (green). Conditions:  $c_{OSMs}$ ,  $2.0 \times 10^{-5} M$ ;  $c_{P1}$ ,  $c_{T1}$ ,  $1.0 \times 10^{-7} M$ ; pH, 7.2.

## 7. The RLS Efficiency ( $\phi_{\text{RLS}}$ ) Definition.

The RLS efficiency ( $\phi_{\text{RLS}}$ ) could be defined as:<sup>S1-S2</sup>

$$\phi_{\text{RLS}} = \frac{C_{\text{sca}}}{C_{\text{ext}}} \quad (1)$$

For  $C_{\text{ext}} = C_{\text{abs}} + C_{\text{sca}}$ ,<sup>S1-S2</sup> thus, Eq. (1) can be changed as Eq. (2):

$$\phi_{\text{RLS}} = \frac{C_{\text{sca}}}{C_{\text{ext}}} = \frac{C_{\text{sca}}}{C_{\text{abs}} + C_{\text{sca}}} \quad (2)$$

For  $\varepsilon = 2.63 \times 10^{20} C_{\text{ext}}$ ,<sup>S1-S2</sup> thus, Eq. (2) can be changed as Eq. (3):

$$\phi_{\text{RLS}} = \frac{C_{\text{sca}}}{C_{\text{ext}}} = \frac{C_{\text{sca}}}{C_{\text{abs}} + C_{\text{sca}}} = \frac{2.63 \times 10^{20} C_{\text{sca}}}{\varepsilon} \quad (3)$$

Wherein  $C_{\text{sca}}$ ,  $C_{\text{ext}}$ , and  $C_{\text{abs}}$  are the light scattering cross section, the extinction cross section, and the absorption cross section, respectively;  $\varepsilon$  is the molar extinction coefficient ( $\text{M}^{-1} \text{cm}^{-1}$ ). Two methods can be used to measure the  $C_{\text{sca}}$  in order to measure  $\phi_{\text{RLS}}$ , one is using a fluorophore for calibration, and another is using standard scattering suspensions obeying Rayleigh scattering law.<sup>S1</sup> Since the latter one is comparatively simple, thus here we employed polystyrene latex particles of 110 nm in diameter as a standard. We choose polystyrene latex particles since it has proved that the light scattering of particles with the diameter ranging from 20 to 400 nm obey Rayleigh light scattering law when excited with the incident light of 300-800 nm, and its RLS efficiency is a unit ( $\phi_{\text{RLS}}=1$ ) at any convenient wavelength since it is a pure light scatterer and its refractive index is always real.<sup>S2</sup> Therefore, we can calculate the RLS efficiency of our sample (X) as follows at a convenient wavelength ( $\lambda$ ):

$$\frac{I_{\text{PS}}(\lambda)}{I_{\text{X}}(\lambda)} = \frac{C_{\text{sca}}^{\text{PS}}(\lambda)N_{\text{PS}}}{C_{\text{sca}}^{\text{X}}(\lambda)N_{\text{X}}} = \frac{\phi_{\text{LS}}^{\text{PS}}(\lambda)C_{\text{ext}}^{\text{PS}}(\lambda)N_{\text{PS}}}{\phi_{\text{LS}}^{\text{X}}(\lambda)C_{\text{ext}}^{\text{X}}(\lambda)N_{\text{X}}} \quad (4)$$

Where X represents sample, PS represents polystyrene latex particles,  $I$  is the measured RLS intensity, and  $N$  is the concentration.  $C_{\text{ext}}$  can be measured according to

molar-extinction coefficient with  $\varepsilon=2.63 \times 10^{20} C_{\text{ext}}$ . Thus, Eq. (5) can be changed as a practically useful form:

$$\frac{\varphi_{\text{RLS}}^{\text{X}}(\lambda)}{\varphi_{\text{RLS}}^{\text{PS}}(\lambda)} = \frac{\varepsilon_{\text{PS}}(\lambda) N_{\text{PS}}}{\varepsilon_{\text{X}}(\lambda) N_{\text{X}}} \cdot \frac{I_{\text{X}}(\lambda)}{I_{\text{PS}}(\lambda)} = \frac{A_{\text{PS}}(\lambda)}{A_{\text{X}}(\lambda)} \cdot \frac{I_{\text{X}}(\lambda)}{I_{\text{PS}}(\lambda)} \quad (5)$$

When choose polystyrene latex particles as a standard ( $\varphi_{\text{RLS}}^{\text{PS}}(\lambda) = 1$ ), the sample RLS efficiency ( $\varphi_{\text{RLS}}^{\text{X}}(\lambda)$ ) could be calculated by Eq. (6).

$$\varphi_{\text{RLS}}^{\text{X}}(\lambda) = \frac{A_{\text{PS}}(\lambda)}{A_{\text{X}}(\lambda)} \cdot \frac{I_{\text{X}}(\lambda)}{I_{\text{PS}}(\lambda)} \quad (6)$$

In which  $A_{\text{PS}}(\lambda)$  and  $A_{\text{X}}(\lambda)$  represent the absorbance of polystyrene latex particles and sample respectively. According Eq. (6), the RLS efficiency ( $\varphi_{\text{RLS}}^{\text{PS}}(\lambda)$ ) of the complexes formed by hybridization productions and AY are present in table S1. The results show that different hybridization productions in the presence of AY can produce different RLS efficiencies, and the full complementary production in the presence of AY has the highest RLS efficiency.

**Table S1 The RLS efficiency ( $\varphi_{\text{RLS}}^{\text{X}}(\lambda)$ ) of the complexes ( $n=3$ )**

Complexes	P1≈T1-AY	P1-MT1-AY	P1-fsDNA-AY	P2≈T2-AY	P3≈T3-AY
$\varphi_{\text{RLS}}^{\text{X}}(\lambda)$	0.47	0.27	0.14	0.012	0.22
Conditions: $c_{\text{AY}}, 2.0 \times 10^{-5} \text{M}$ ; all DNA concentrations are $1.0 \times 10^{-7} \text{M}$ ; pH, 7.2, $\lambda$ , 494.4 nm.					

## 8. Fluorescence polarization and anisotropy values

The fluorescence polarization ( $P$ ) and anisotropy ( $r$ ) values are calculated according to following equation.

$$P = \frac{I_{//} - I_{\perp}}{I_{//} + I_{\perp}} \quad r = \frac{I_{//} - I_{\perp}}{I_{//} + 2I_{\perp}}$$

**Table S2 Fluorescence polarization values of AY in presence of P1-T1.**

Concentration of P1≈T1 (10 <sup>-7</sup> M)	0	0.25	0.50	0.75	1.0
Polarization (P)	0.216	0.219	0.227	0.269	0.280
Anisotropy (r)	0.155	0.158	0.164	0.197	0.206

Conditions:  $c_{AY}$ , 2.0×10<sup>-5</sup>M; pH, 7.2;  $\lambda_{ex}$ , 445 nm;  $\lambda_{em}$ , 504 nm.

### References

S1 J.Yguerabide, E. E.Yguerabide, Anal. Biochem. **1998**, 262, 137–156.

S2 J.Yguerabide, E. E.Yguerabide, Anal. Biochem. **1998**, 262, 157–176.