Supporting Information

Monodispersed nanoparticles of conjugated polyelectrolyte brush with high charge density for rapid, specific and label-free detection of tumor marker

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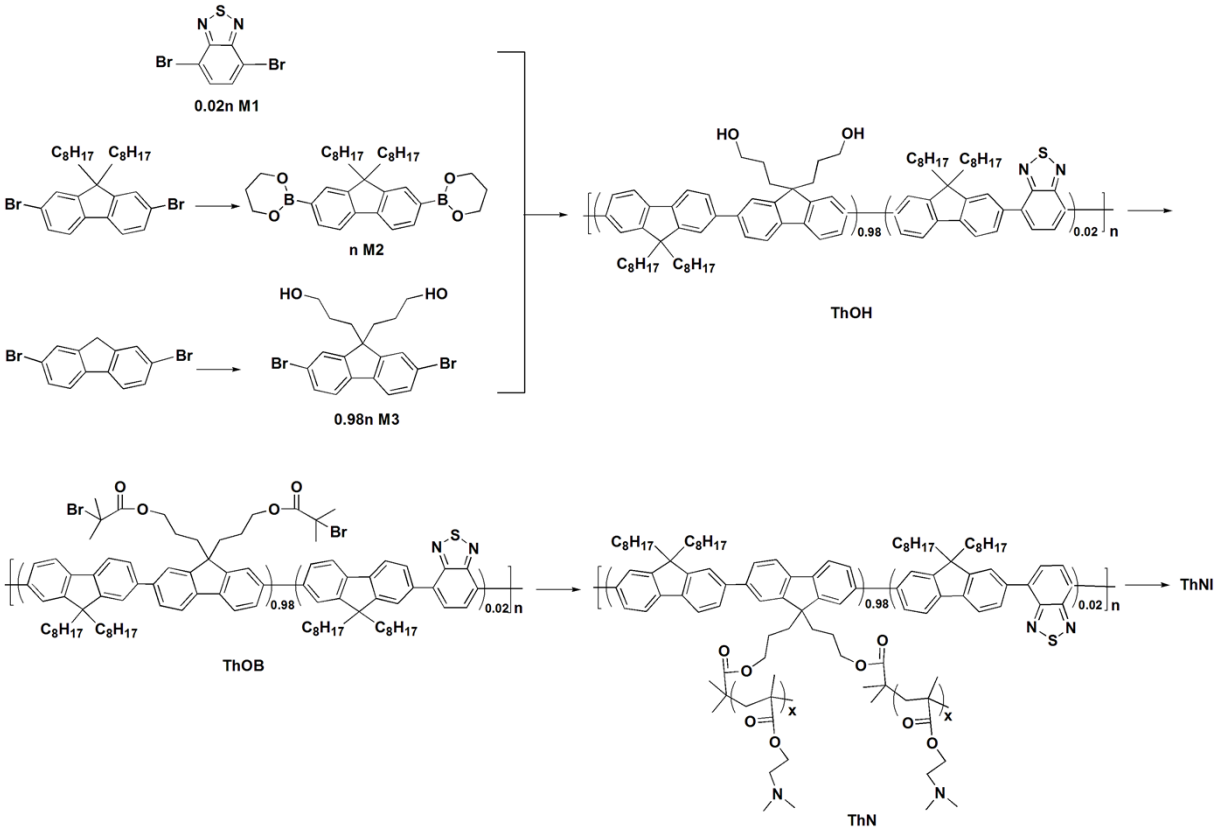
EXPERIMENTAL SECTION

Materials and Chemicals. The concentration of ThNI is calculated in repeat units of monomer. Human α-fetoprotein, prostate specific antigen, and immunoglobulin were purchased from Linc-bio Science Co., Ltd (Shanghai, China). Thrombin and lysozyme were purchased from Sigma-Aldrich. Bovine serum albumin was purchased from Hangzhou Haoxin Biotech Co., Ltd. Other chemicals were purchased from Sigma-Aldrich, Acros, and Alfa and were used as received. All solutions were prepared with Milli-Q water (18.2 MΩ.cm) from a Millipore system.

Experimental Procedures. Protein solutions of certain volume were added to 2 μL ThNI solution (100 μM), after an incubation at 37℃ for 10 min, PBS buffer (20 mM PBS, 140 mM NaCl, pH 7.4) was add to a final volume of 400 μL to record fluorescence spectra. Control experiments with the other non-specific proteins were carried out under otherwise identical conditions.

Methods. All fluorescence spectra were recorded in quartz cuvettes with an optical path length of 1.0 cm and at an excitation wavelength of 387 nm on a Shimadzu RF-5301 spectrofluorometer equipped with a Xenon lamp excitation source. UV-vis absorption spectra were recorded on a Shimadzu 3600 spectrophotometer. Data of dynamic light scattering (DLS) and zeta potential were obtained on a Brookhaven ZetaPALS Zeta Potential Analyzer upon excitation at 659 nm. Transmission electron microscopy (TEM) images were recorded on a JEOL 2010 transmission electron microscope at an accelerating voltage of 100 kV.

FIGURES



Scheme S1 Synthesis route of conjugated polyelectrolyte brush ThNI (Z. Zhang, Degree Thesis, Nanjing University of Posts and Telecommunications, June, 2012.)

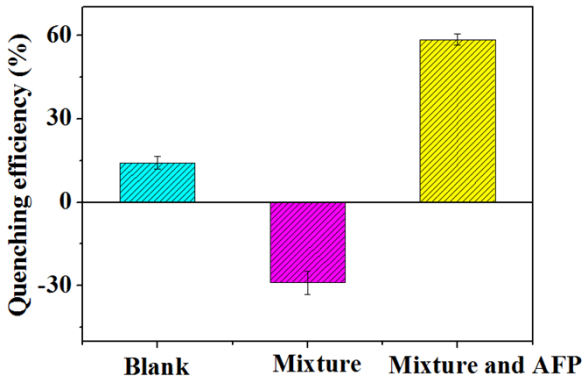


Figure S1. Quenching efficiency of the mixture (mixed solution of BSA, IgG, Lys, PSA and Thro, 20 nM each) without or with AFP (20 nM).

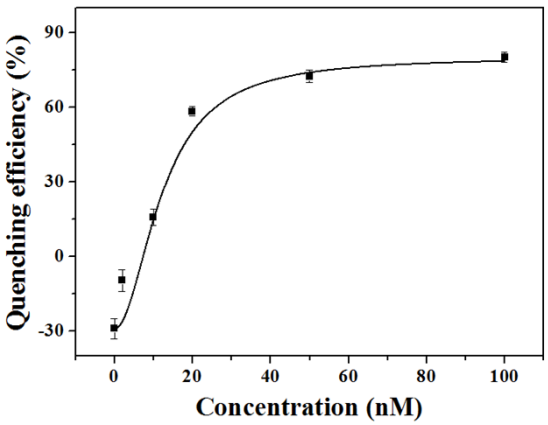


Figure S2. Quenching efficiency of AFP at different concentrations (0, 2, 10, 20, 50, 100 nM) in the mixture of several proteins.

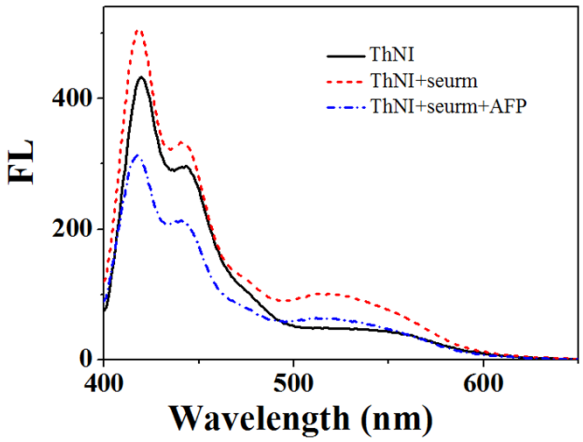


Figure S3. Fluorescence response of ThNI to serum and AFP (20 nM) in serum.

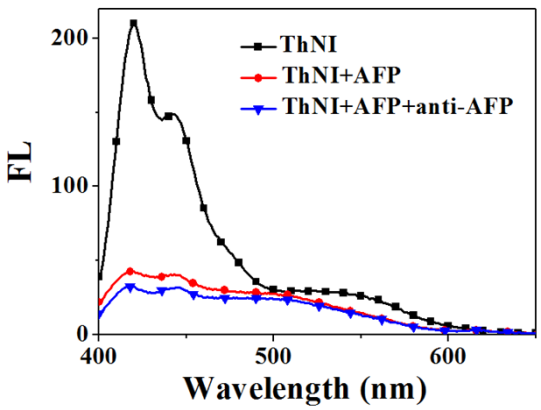


Figure S4. Fluorescence spectra of ThNI upon addition of AFP and anti-AFP

TABLES

Table S1. Comparison of performance of several major protein assays based on fluorescence quenching of CPs.

CP	protein	K_{sv} (M^{-1})	Specificity	Reference
Conjugated polyelectrolyte brush (ThNI)	AFP	2.44×10^8	Excellent	Our
	Lys, BSA, IgG, PSA and Thro	−3% to −30% quenching		
Sulfonated PPV	Cyt *c*	3.2×10^8	good	[16a]
	myoglobin	10^6		
	lysozyme	50% quenching		
α-mannose-bearing PPP	Con A	4.5×10^7	Good	[16c]
Sulfonated PF	Cyt *c*	2.27×10^8	medium	[16g]
	hemin	5.31×10^7		
	methemoglobin	3.81×10^7		
Carboxylate-substituted PPE	histone	2.8×10^7	bad	[16b]
	hemoglobin	1.3×10^6		
	myoglobin	6.9×10^5		
	Cyt *c*	6.5×10^5		
	lysozyme	2.2×10^5		
	BSA	-4.3×10^6		

Table S2. Zeta potential values and DLS data of ThNI with or without proteins.

Parameter	ThNI	ThNI+AFP	ThNI+control protein				
			Lys	PSA	Thro	BSA	IgG
ξ (mV)	+ 48.65	− 8.52	+ 56.48	+ 50.00	+ 16.90	+ 28.55	+ 27.99
DLS (nm)	38.2	57.5	67.1	104.4	105.7	122.3	64.8