



## Supporting Information

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**A Metal Chelator as a Plasmonic Signal-Generation Superregulator for Ultrasensitive Colorimetric Bioassays of Disease Biomarkers**

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### **A Metal Chelator as a Plasmonic Signal-Generation Superregulator for Ultrasensitive Colorimetric Bioassays of Disease Biomarkers†**

Qian Zhao,<sup>‡a</sup> Jiafang Piao,<sup>‡a</sup> Weipan Peng,<sup>a</sup> Jun wang,<sup>b</sup> Weichen Gao,<sup>a</sup> Xiaoli Wu,<sup>a</sup> Hanjie Wang,<sup>a</sup>  
Xiaoqun Gong,<sup>\*a</sup> Jin Chang<sup>\*a</sup> and Bingbo Zhang<sup>\*b</sup>

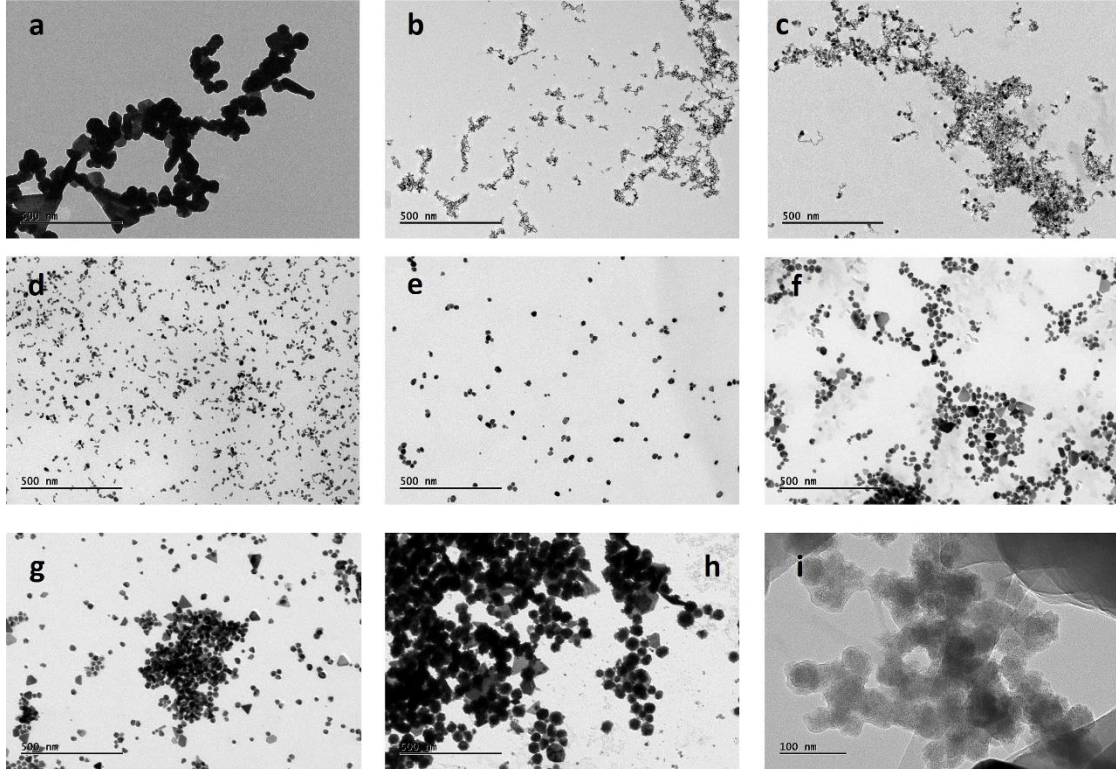
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<sup>†</sup>Electronic supplementary information (ESI) available. See DOI:

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**Figure S1.** TEM images of AuNPs synthesized with varying concentrations of HAuCl<sub>4</sub> in the solution of 2.0 mM trisodium citrate at 37 °C. a-i) The concentrations of HAuCl<sub>4</sub> were 0.25 mM, 0.5 mM, 0.6 mM, 0.9 mM, 1 mM, 1.25 mM, 1.5 mM, 1.75 mM and 2.5 mM, respectively.

### Calculation of the chelating efficiency of EDTA•2Na@SiO<sub>2</sub> nanoparticles with Au<sup>3+</sup> ions

Theoretical Models:

$$\begin{aligned}
 N(\text{SiO}_2\text{NPs}) &= \frac{m(\text{SiO}_2\text{NPs})}{\rho(\text{SiO}_2\text{NPs}) \times \frac{4}{3}\pi(r_{\text{SiO}_2\text{NP}})^3} \\
 &= \frac{0.75\text{mg}}{2\text{mg/cm}^3 \times \frac{4}{3}\pi(250\text{nm})^3} \\
 &= 5.74 \times 10^{12}
 \end{aligned}
 \tag{Eqn.1}$$

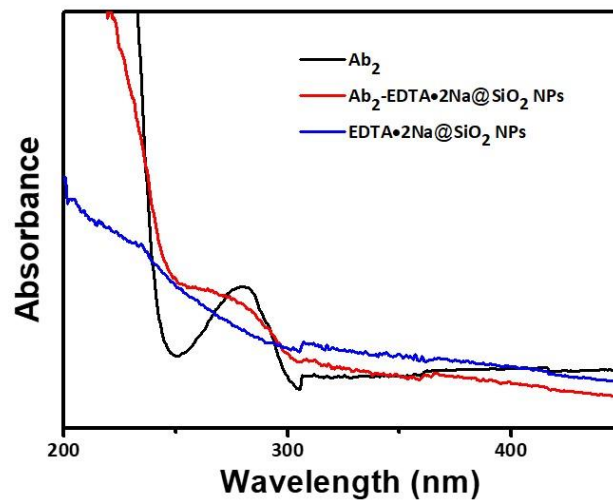
$$\begin{aligned}
 &= \frac{m(\text{Au})}{M(\text{Au})} \times N_A = \frac{2.079\mu\text{g}}{197\text{g/mol}} \times 6.02 \times 10^{23} \\
 &= 6.36 \times 10^{15}
 \end{aligned}
 \tag{Eqn.2}$$

$$R_{\text{Au on one SiO}_2\text{NP}} = \frac{N(\text{Au})}{N(\text{SiO}_2\text{NPs})} = \frac{6.36 \times 10^{15}}{5.74 \times 10^{12}} = 1108.01 \quad \text{Eqn.3}$$

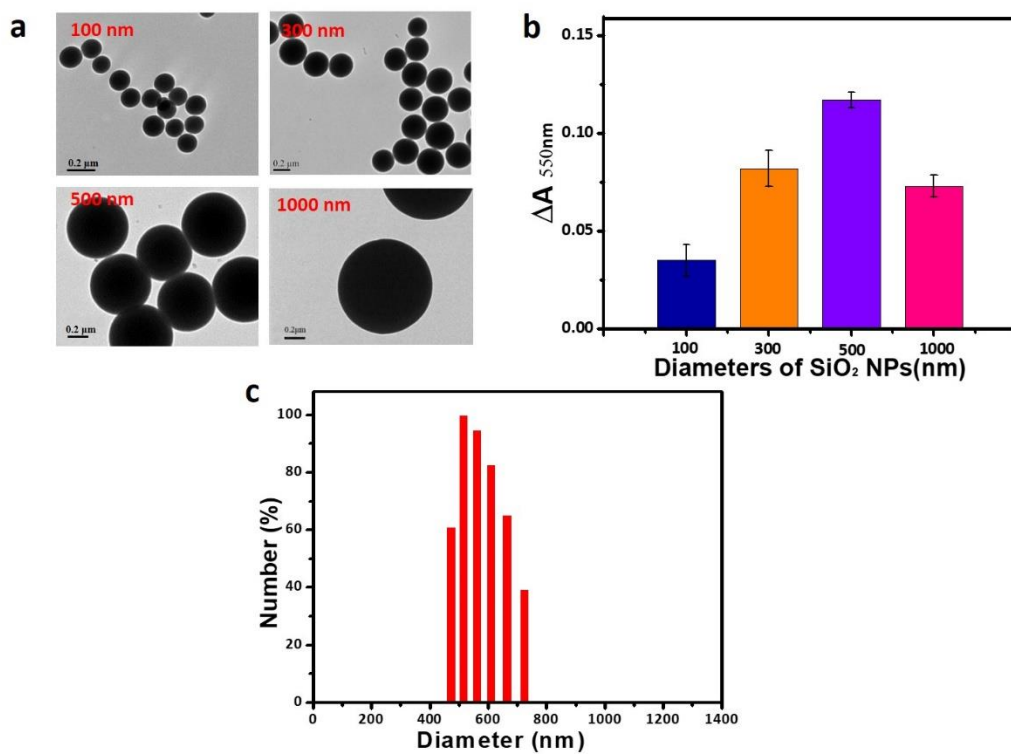
$N(\text{SiO}_2\text{NPs}) = \text{SiO}_2\text{NP number}$

$N(\text{Au}) = \text{Au number}$

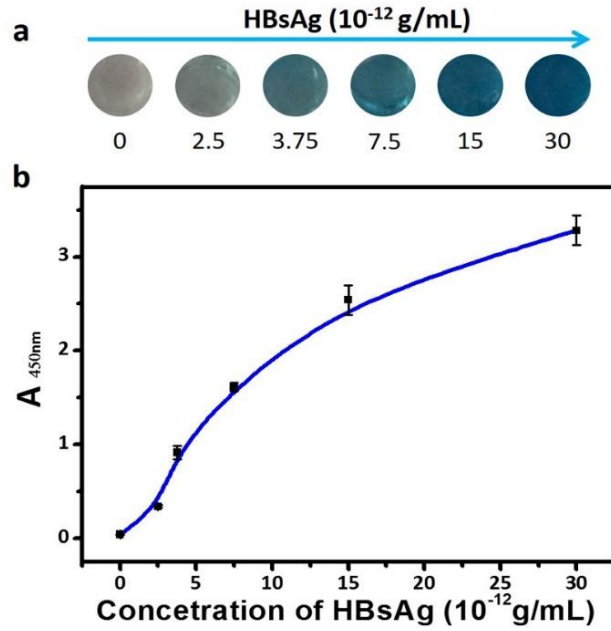
$R_{\text{Au on one SiO}_2\text{NP}} = \text{the ratio of the Au number with a SiO}_2\text{NP}$



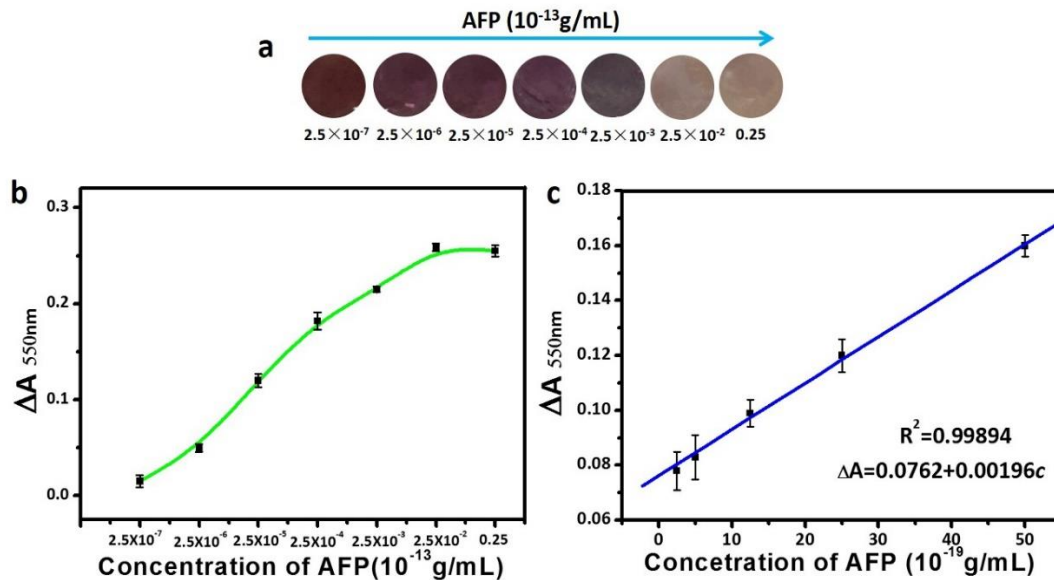
**Figure S2.** The UV-vis absorption spectra of  $\text{Ab}_2$  (black line),  $\text{EDTA}\cdot 2\text{Na} @\text{SiO}_2$  NPs (blue line) and the purified  $\text{Ab}_2\text{-EDTA}\cdot 2\text{Na} @\text{SiO}_2$  NPs bioconjugates (red line).



**Figure S3.** Investigation the effect of diameters of SiO<sub>2</sub> NPs on the detection sensitivity of HBsAg. a) TEM images of SiO<sub>2</sub> NPs with different diameters (100 nm, 300 nm, 500 nm and 1000 nm). b) ΔA value of the generated AuNPs by Scadge-Diag. c) The size distribution of SiO<sub>2</sub> NPs (500 nm) by dynamic light scattering. The results showed that the SiO<sub>2</sub> NPs homogeneously dispersed in the solution and the real size of the SiO<sub>2</sub> NPs was 561.3±48 nm. 500 nm-sized was just used as a code for an easy recognition.



**Figure S4.** Conventional HRP based a commercial enzyme-linked immunosorbent assay (ELISA) kit for quantitative determination of HBsAg. a) Representative photographs taken from the detection solutions of HBsAg with various concentrations ( $0$ ,  $2.5 \times 10^{-12}$  g/mL,  $3.75 \times 10^{-12}$  g/mL,  $7.5 \times 10^{-12}$  g/mL,  $15 \times 10^{-12}$  g/mL,  $30 \times 10^{-12}$  g/mL). b) Corresponding plots of  $A_{450\text{nm}}$  values *versus* different concentrations of HBsAg in ELISA with a limit of detection of  $2.5 \times 10^{-12}$  g/mL.



**Figure S5.** Detection of AFP by Scadge-Diag platform. a) Tonality images of detection solutions with different concentrations of AFP by naked-eye. b) Plotting absorbance values of AuNPs collected at 550 nm *versus* varying concentrations of AFP. c) Calibration curves between the

concentrations of  $2.5 \times 10^{-19} \sim 5 \times 10^{-18}$  g/mL.

**Table S1.** The cost comparison of HRP and EDTA•2Na obtained from manufacturers abroad and domestic.

Monetary unit: RMB

	SIGMA	Chemart (tianjin) Chemical Technology Co., Ltd.
HRP	1302.21 (100 mg)	190 (10 mg)
EDTA•2Na	315.9 (5 g)	14 (25 g)