SUPPLEMENTARY INFORMATION

Terbium (III)/gold nanoclusters conjugates: the development of a novel ratiometric fluorescent probe for mercury (II) and a paper-based visual sensor

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Animal experiments:

All procedures involving animals were conducted with the approval of the Animal Ethics Committee in ECNU, China. Male rats (weight ranges from 180 to 210 g) were purchased from Shanghai SLAC Laboratory animal Co. Ltd, and acclimatized for 10 days. Over seven consecutive days, the experimental groups of rats were injected intraperitoneally once a day with different concentrations of $HgCl_2$ (0.5 mg Hg/Kg and 1 mg Hg/Kg), which was dissolved in normal saline, while the control group was treated with an equal amount of normal saline solution. Then the rats were anesthetized to death. After dissection and homogenate process, the samples from kindey and liver were stored under -80°C before further use.

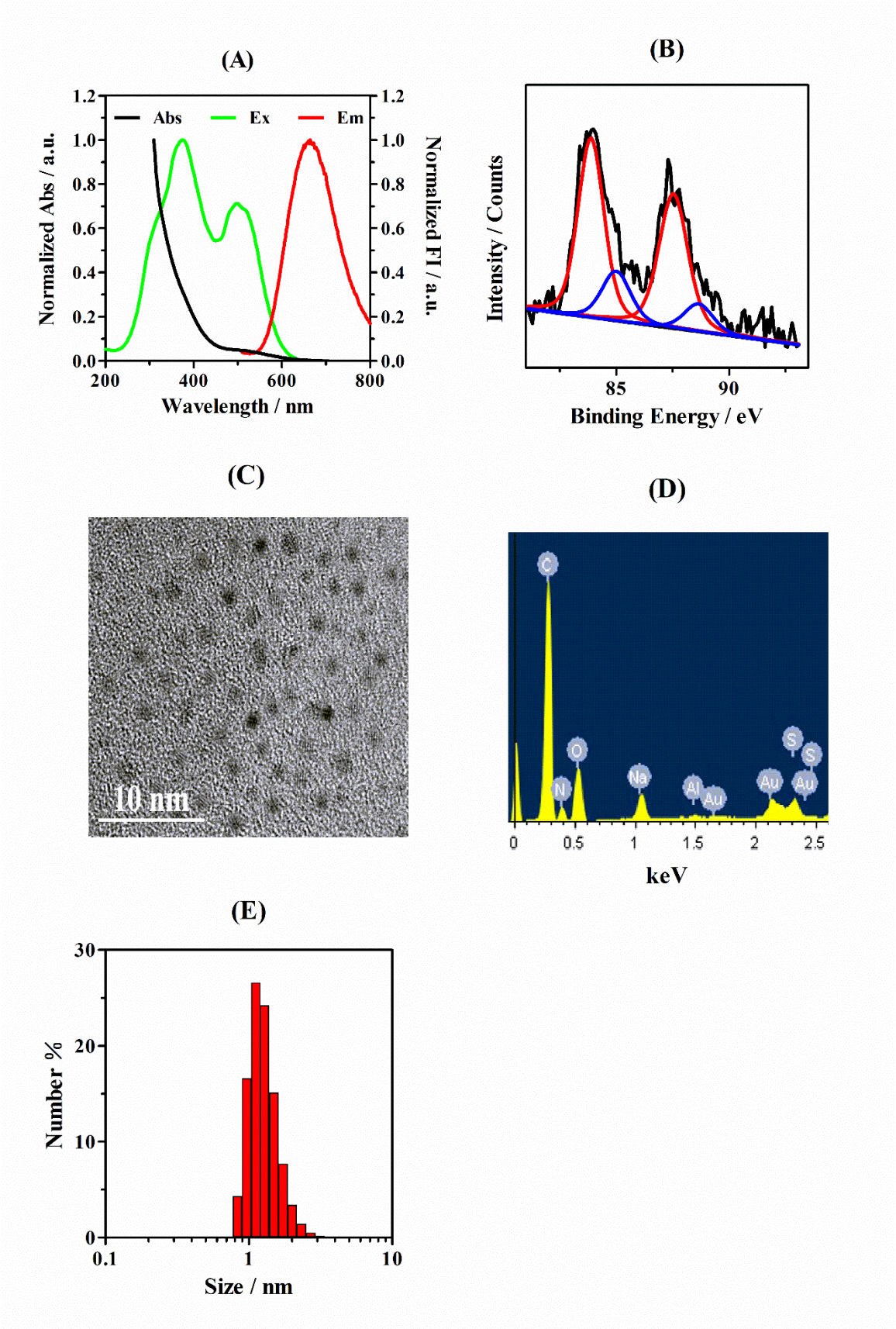

Figure S1. (A) The absorption (black line), excitation (blue line) and emission (red line) spectra of the as-prepared BSA-AuCNs. (B) XPS spectra of the BSA-AuNCs. (C) TEM image of the BSA-AuNCs. (D) Energy Dispersive X-Ray Spectroscopy (EDX)

of BSA-AuNCs. (E) Size characterization of the as-prepared BSA-AuCNs by dynamic light scattering (DLS).

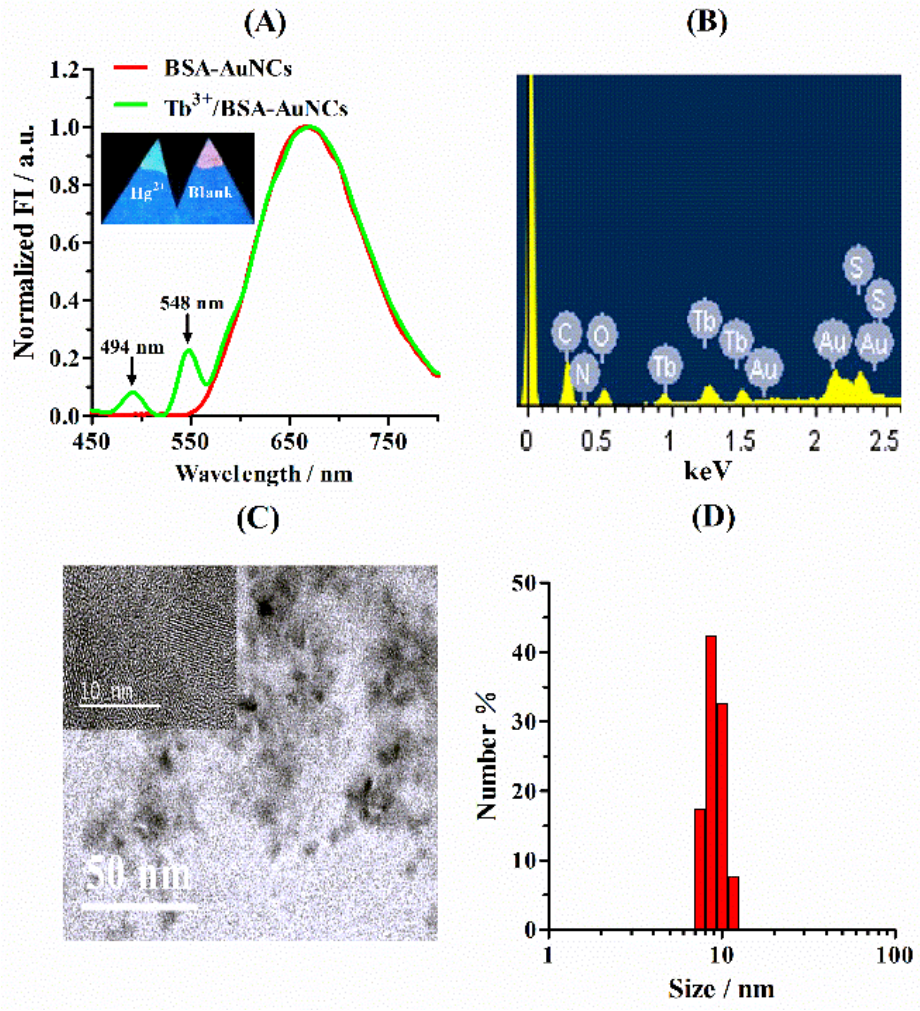

Figure S2. (A) The fluorescence emission spectra of the as-prepared BSA-AuCNs (red line) and Tb^{3+}/BSA-AuNCs (green line). Inset: The photo was taken under a 254 nm UV lamp excitation using a digital camera. (B) Energy Dispersive X-Ray Spectroscopy (EDX) of Tb^{3+}/BSA-AuNCs. (C) TEM image of the Tb^{3+}/BSA-AuNCs. The inserted magnification picture shows the lattice of Au metal. (D) Size characterization of the as-prepared Tb^{3+}/BSA-AuNCs by dynamic light scattering (DLS).

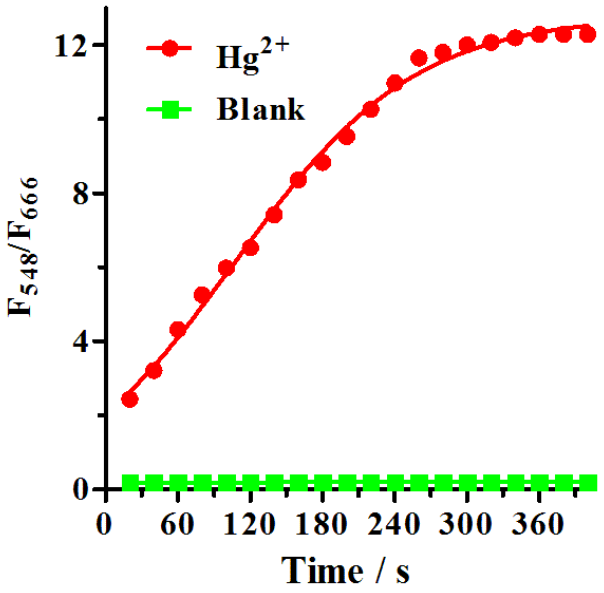

Figure S3. Time-course of the ratiometric fluorescent change (F_{548}/F_{666}) of Tb^{3+}/BSA-AuNCs in the absence and presence of 5 μM Hg^{2+}.

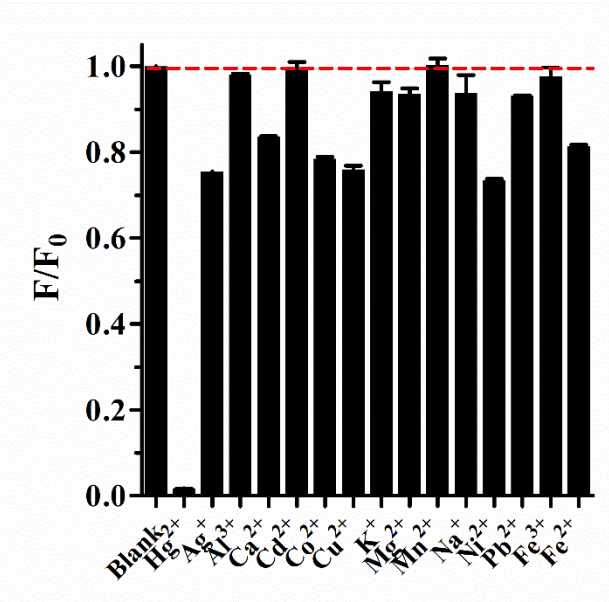

Figure S4. Bars represent the fluorescence responses (F/F_0) of the pure BSA-AuNCs probe toward Hg^{2+} (5 μM) and other metal ions (10 μM). F and F_0 represent the fluorescence of the pure BSA-AuNCs probe in the absence and presence of metal ions.

Table S1. The analytical performance of various Hg^{2+} sensors.

Sensing materials	Signal output	LOD	Linear range	Ref.
AuNP	Colorimetry	13.2 nM	0.01-100 μM	1
Squaraine dye	Fluorimetry	13 nM	1-10 μM	2
GO-based sensor	Fluorimetry	2.6 nM	5-200 nM	3
graphene oxide/Ru-complex	Fluorimetry	2.34 nM	0-6 μM	4
N-CQDs	Fluorimetry	2.91 nM	0-50 nM	5
Lysozyme-AuNCs	Fluorimetry	0.34 μM	0.01-5 μM	6
11-MUA-AuNP	Fluorimetry	5 nM	0-10 μM	7
Tb^{3+}/BSA-AuNCs	Fluorimetry	1 nM	0.005-7 μM	This work

Table S2. Comparison of the concentrations of Hg^{2+} in biological samples determined by our method and the traditional atomic absorption (AAS) spectrometer AMA-254.

Dose	Our Method (nM)		AAS (nM)	
	kidney	liver	kidney	liver
Low Dose	235.87±47.79	33.92±10.73	237.29±53.34	32.33±9.59
High Dose	501.13±78.07	72.93±24.57	502.32±80.01	73.56±25.34

The *t* test and the statistical comparison.

The atomic absorption spectrometer AAS method was taken as a standard method to evaluate the accuracy of our method. A *t* test was made to determine whether the means obtained between our method and AAS method are distinct. The *t* value was calculated according to equation 1

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{s}\sqrt{\frac{n_1 n_2}{n_1 + n_2}} \qquad (1)$$

in which $s = \sqrt{\frac{s_1^2(n_1-1) + s_2^2(n_2-1)}{(n_1-1)+(n_2-1)}}$, s_1 and s_2 represent the standard deviation of determined results by the present method and AAS method, respectively. n_1 and n_2 are sample numbers of our method and AAS method (herein, $n_1 = 3$, $n_2 = 3$). If the *t* value is smaller than standard *t* value, 2.13 (a = 0.1), the result obtained from the present

method was considered to be in agreement with that obtained from AAS method.

Reference:

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