Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Electronic Supplementary Information

Ultrabright, highly heat-stable gold nanoclusters by functional ligands and hydrothermal-induced luminescence enhancement

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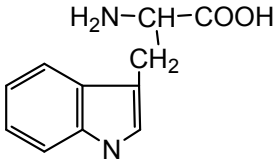
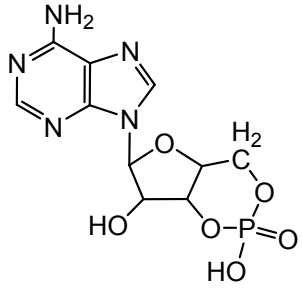
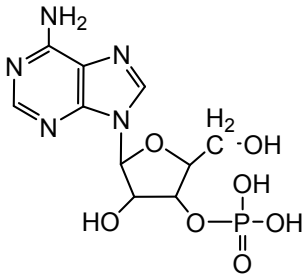
Scheme 2



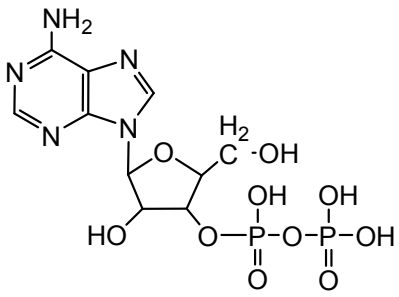
Trp
(tryptophan)



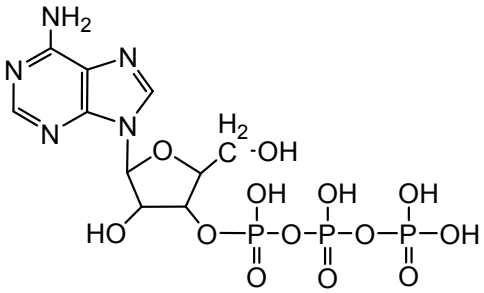
cAMP
(adenosine 1,6-cyclic monophosphate)



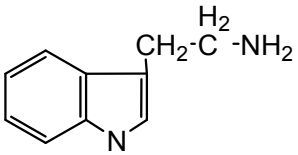
AMP
(adenosine monophosphate)



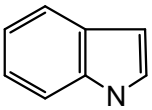
ADP
(adenosine diphosphate)



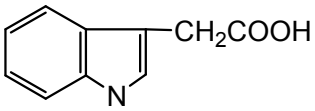
ATP
(adenosine triphosphate)



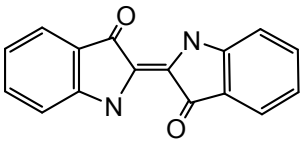
tryptamine



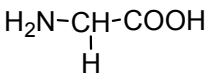
indole



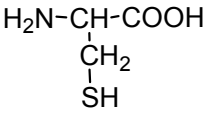
3-indole acetic acid



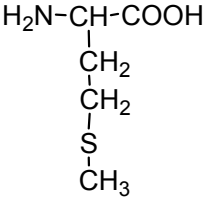
indigo



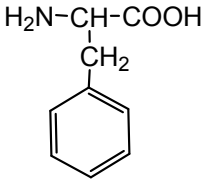
Gly
(glycine)



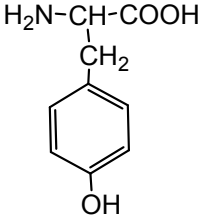
Cys
(cysteine)



Met
(methionine)



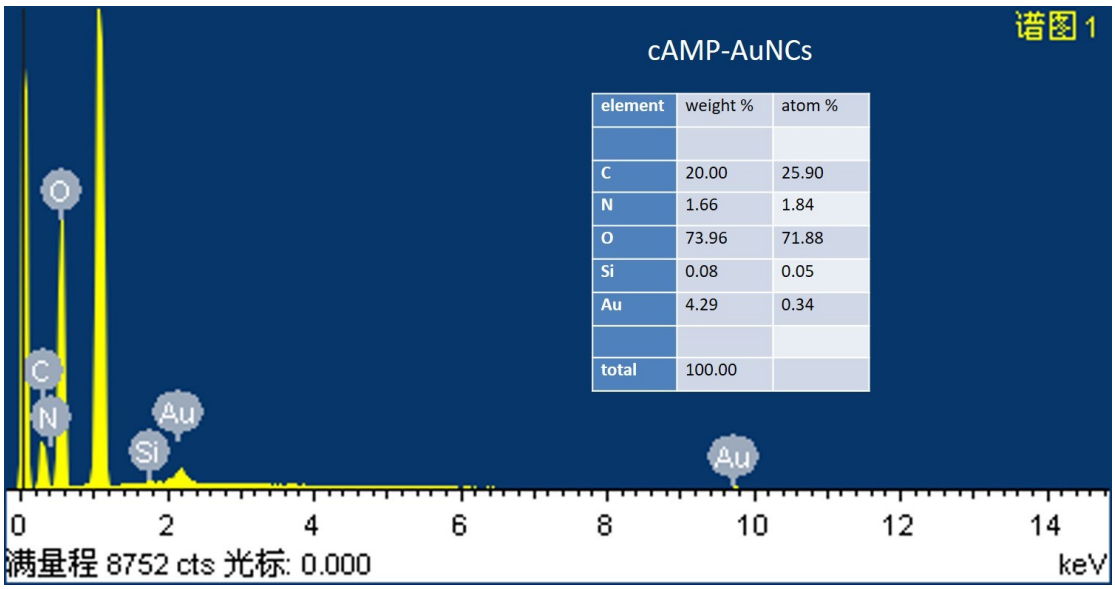
Phe
(phenylalanine)



Tyr
(tyrosine)

Scheme 2. Structure of compounds.

Figure S1



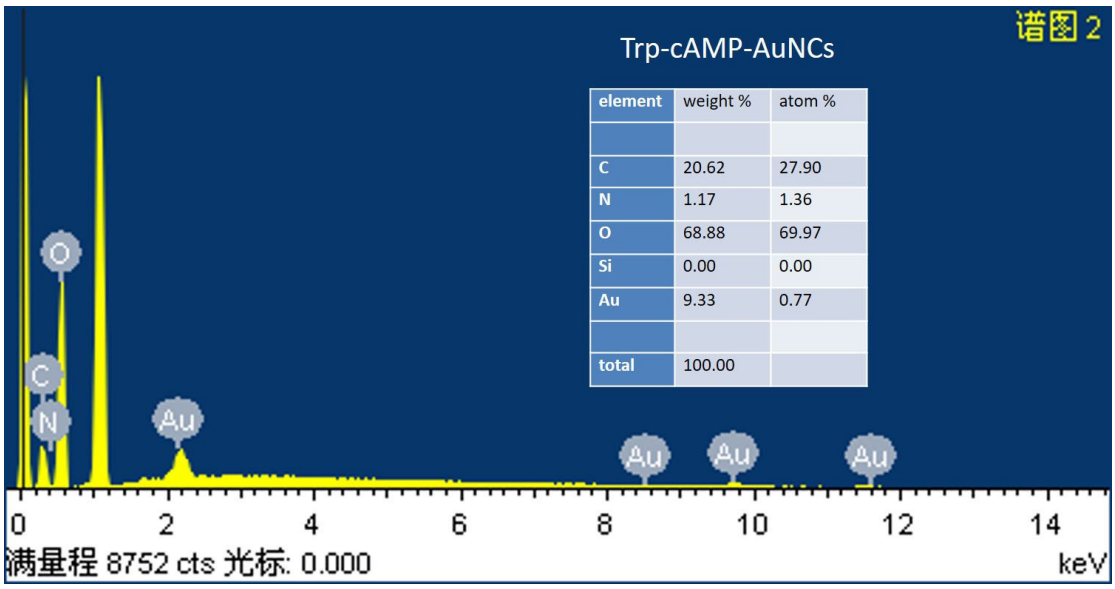


Figure S1. Energy-dispersive X-ray spectra (EDS) of cAMP-AuNCs and Trp-cAMP-AuNCs.

Figure S2

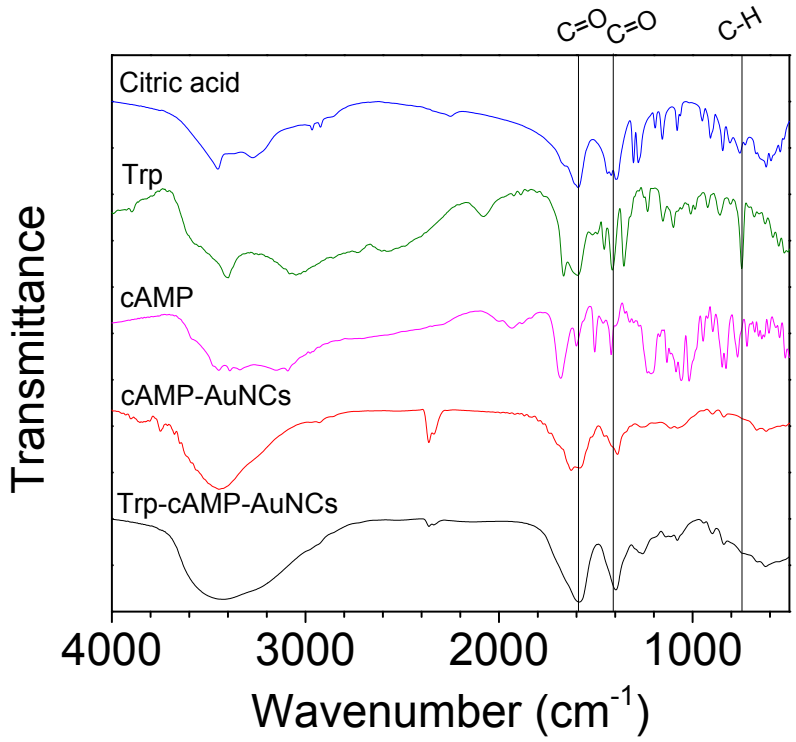


Figure S2. FT-IR spectra of Trp-cAMP-AuNCs, cAMP-AuNCs, cAMP, Trp (tryptophan) and citrate. V: stretching vibration, ρ: bending vibration.

Figure S3

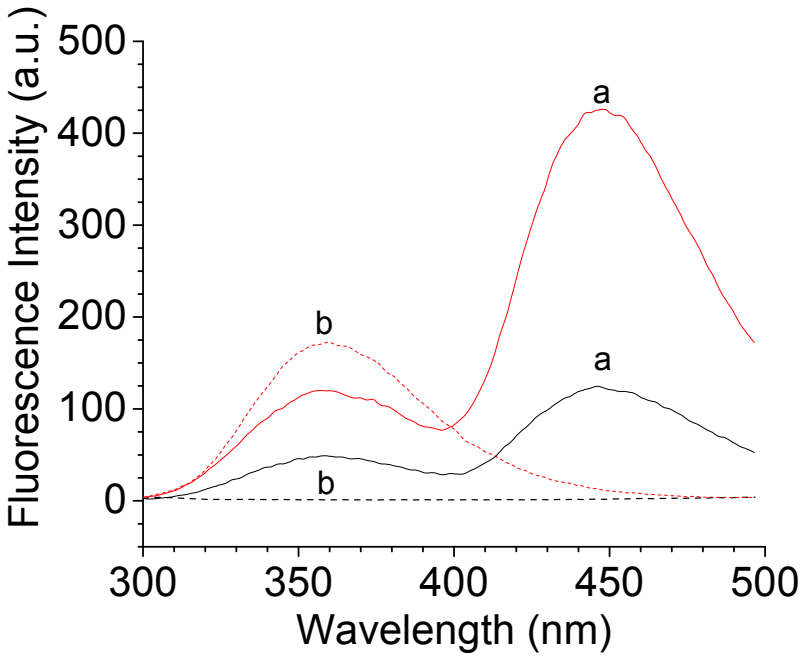


Figure S3. Fluorescence intensity of Trp-cAMP-AuNCs (a, solid line) and Trp (b, dash line) before (red) and after (black) a dialysis purification.

Figure S4

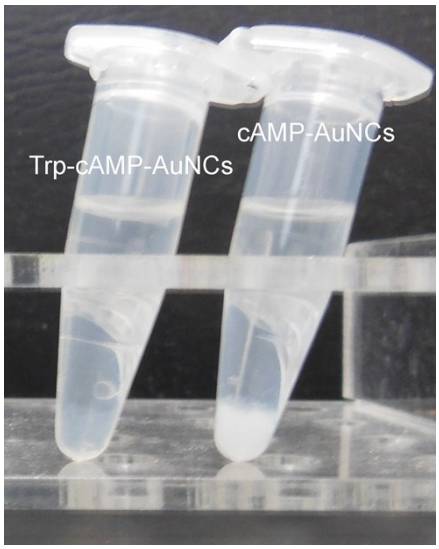


Figure S4. Comparison of the solubility of cAMP-AuNCs and Trp-cAMP-AuNCs in a solution of 8:1 ratio (v/v) of ethanol to water. Trp-cAMP-AuNCs solution is almost transparent whereas cAMP-AuNCs solution became sedimentary.

Figure S5

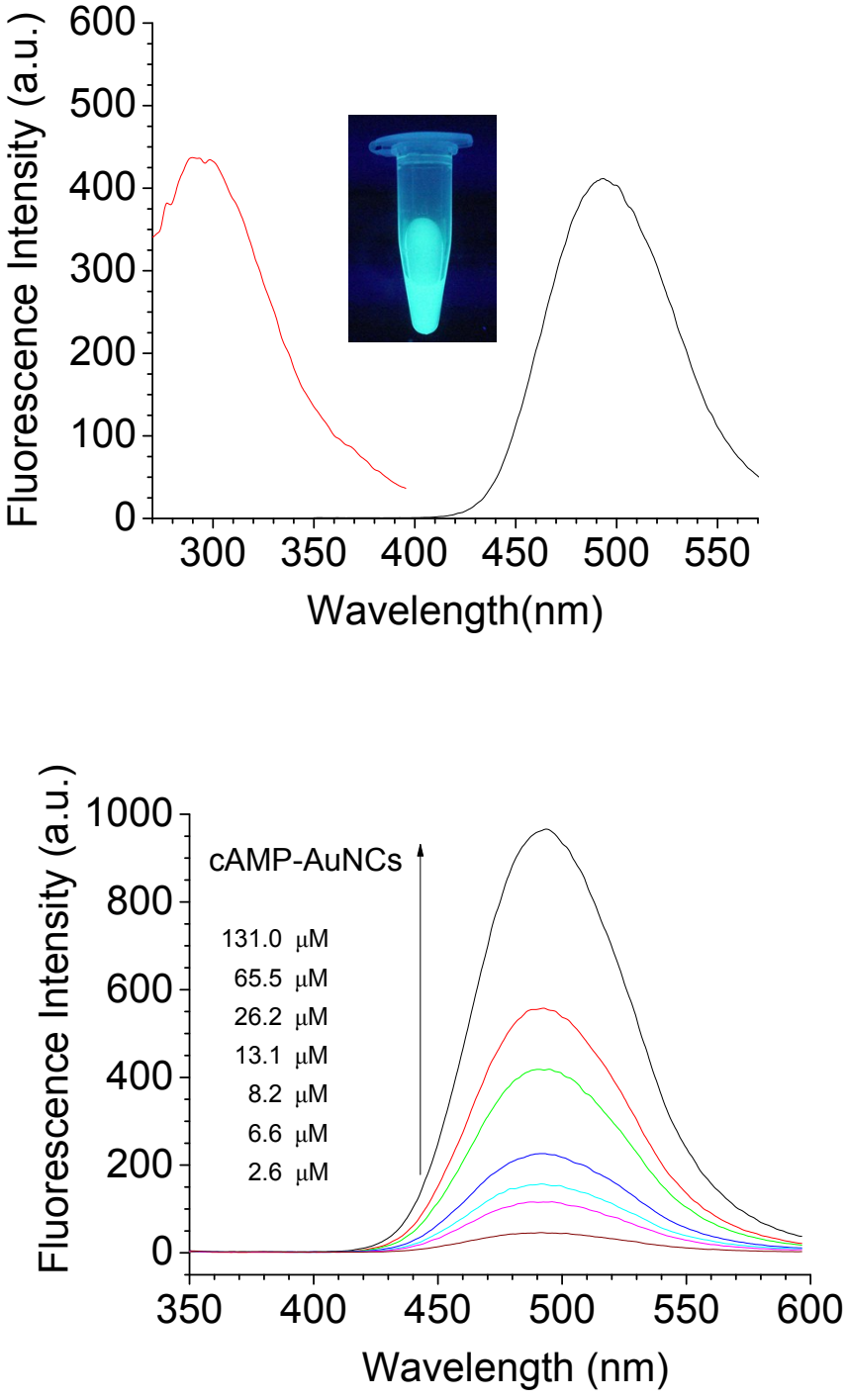


Figure S5. Emission (black) and excitation (red) spectra of cAMP-AuNCs solution (50 μM=50×197=9850 μg/L) (upper). Fluorescence intensity of cAMP-AuNCs solution increased with its concentration (lower).

Figure S6

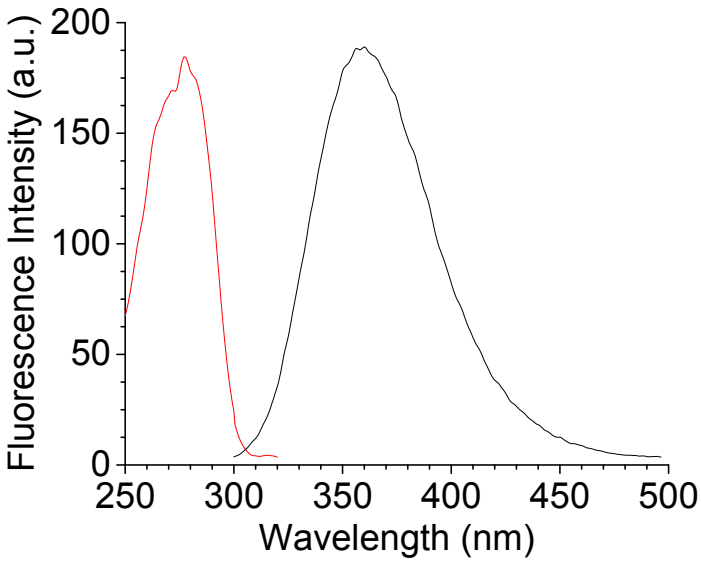


Figure S6. Emission (black) and excitation (red) spectra of tryptophan (Trp) solution (2.5 μM). Excitation wavelength for the emission spectrum and observed wavelength for the excitation spectrum are 277 and 360 nm, respectively.

Figure S7

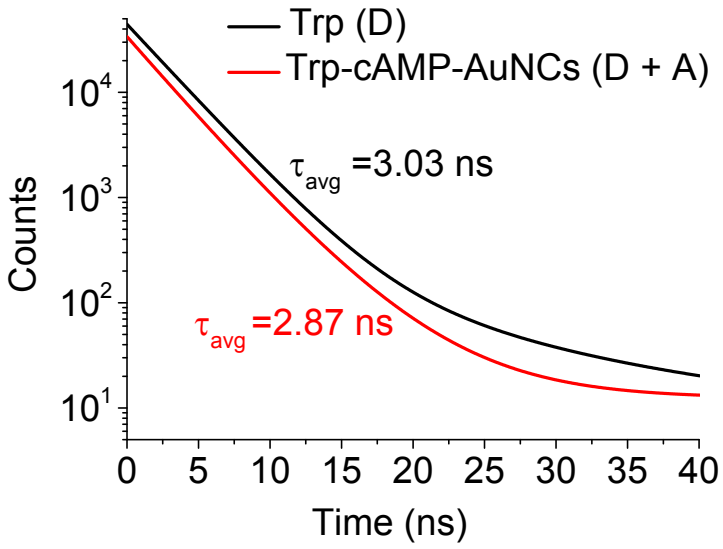


Figure S7. Fluorescence lifetime of Trp (black) and Trp-cAMP-AuNCs (red) in which Trp as a donor and cAMP-AuNCs as an acceptor. The excitation wavelength is 279 nm and the observation wavelength is 360 nm.

Figure S8

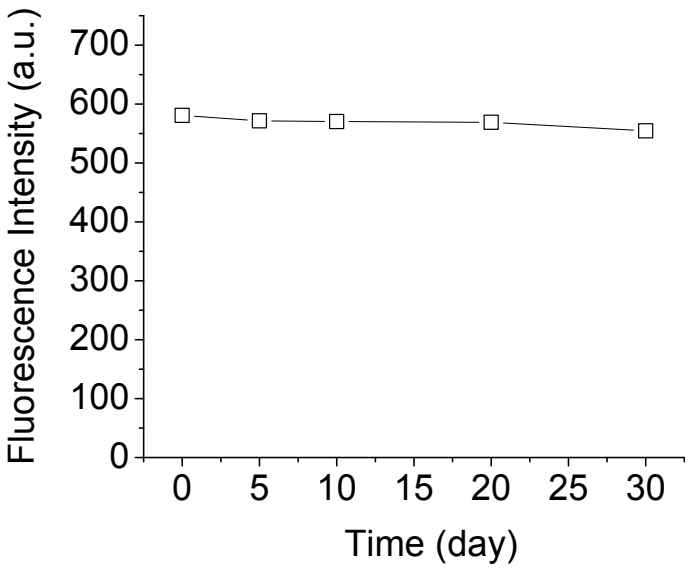


Figure S8. Stability of the fluorescence of Trp-cAMP-AuNCs solution.

Figure S9

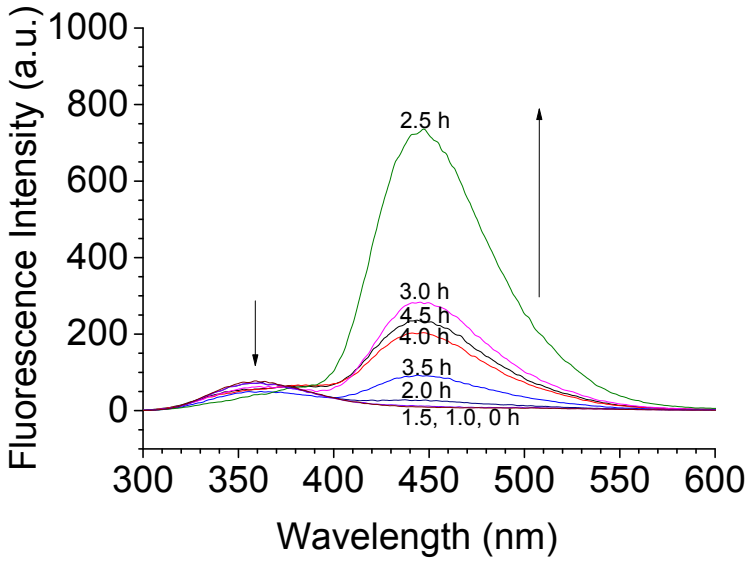


Figure S9. Effect of hydrothermal reaction time on the fluorescence of Trp-cAMP-AuNCs.

Figure S10

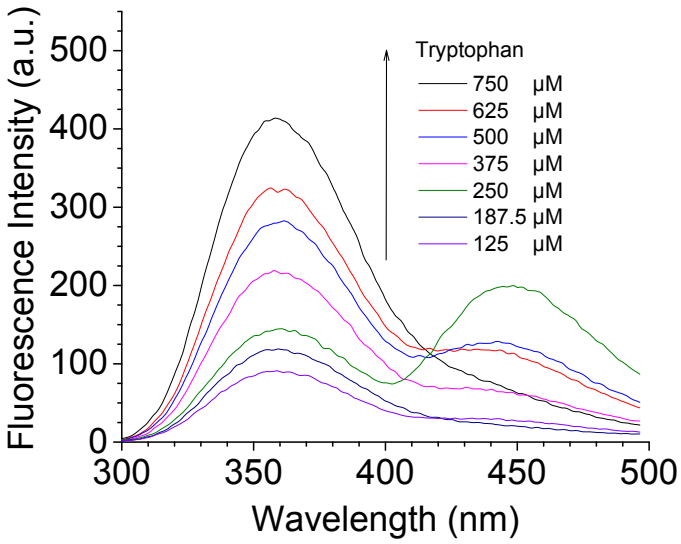


Figure S10. Effect of the concentration of tryptophan on the fluorescence of Trp-cAMP-AuNCs solution.

Figure S11

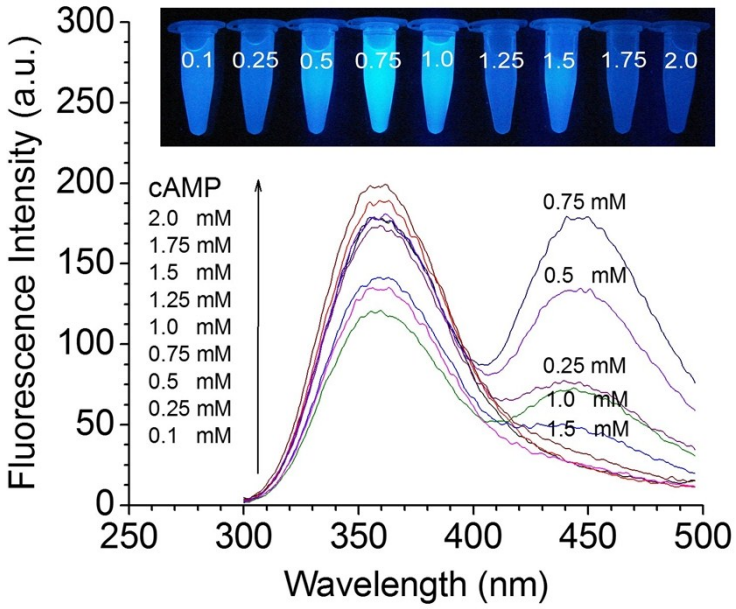


Figure S11. Effect of the concentration of cAMP on the fluorescence of Trp-cAMP-AuNCs solution.

Figure S12

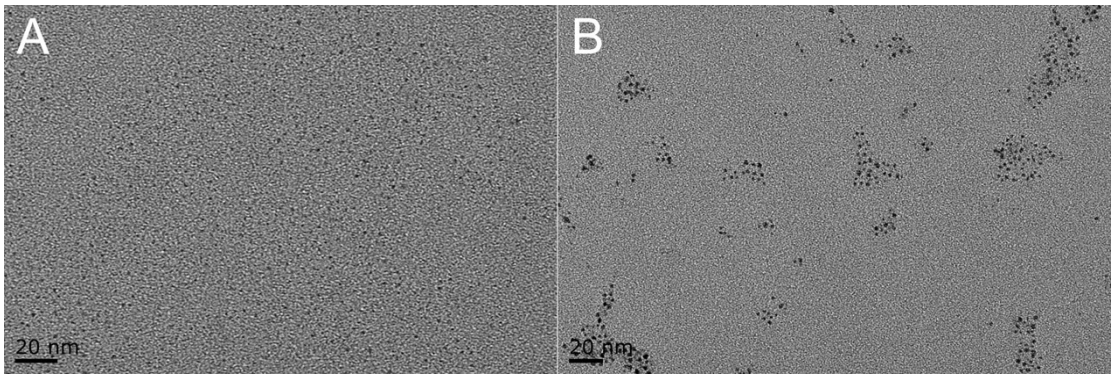


Figure S12. TEM images of BSA-Au NCs (a) and GSH-Au NCs (b).

Figure S13

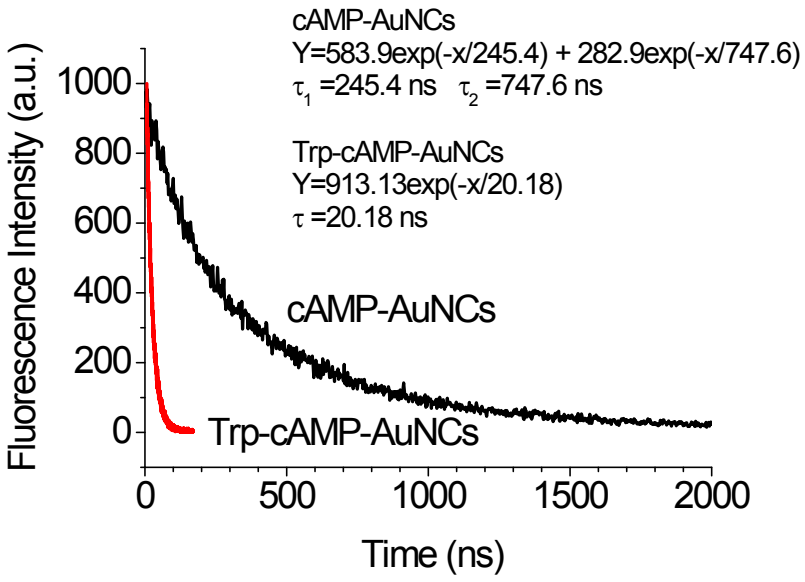
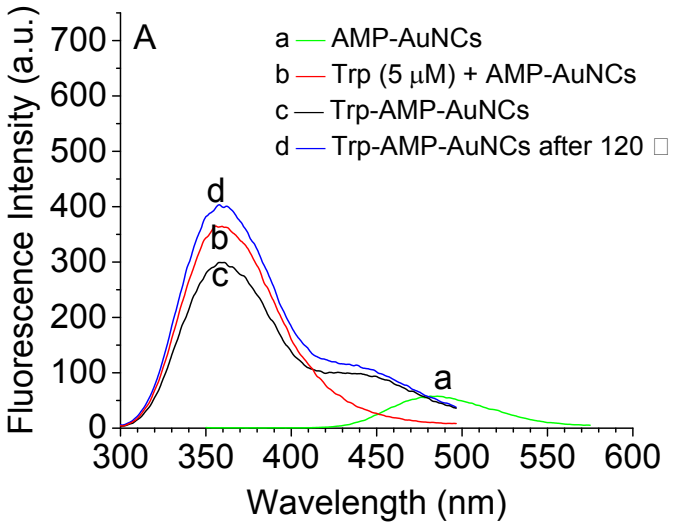
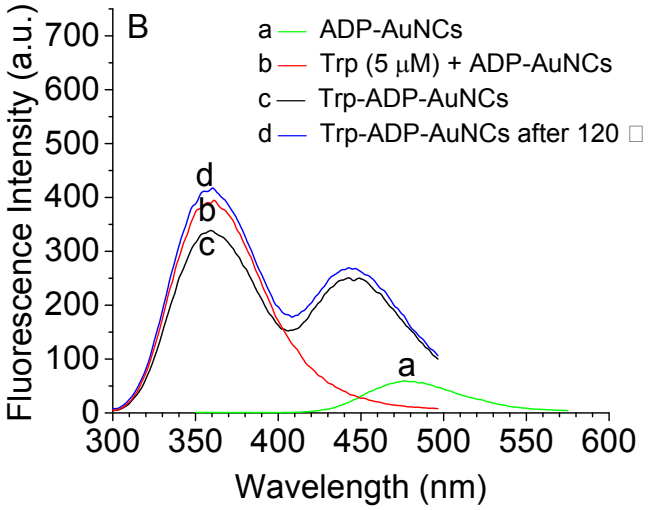


Figure S13. Fluorescence lifetime of Trp-cAMP-AuNCs (red) and cAMP-AuNCs (black). The excitation wavelength is 258 nm and the observation wavelength is 360 nm.

Figure S14


A
a AMP-AuNCs
b Trp (5 μM) + AMP-AuNCs
c Trp-AMP-AuNCs
d Trp-AMP-AuNCs after 120
Fluorescence Intensity (a.u.)
Wavelength (nm)
0
100
200
300
400
500
600
700
300
350
400
450
500
550
600


B
a ADP-AuNCs
b Trp (5 μM) + ADP-AuNCs
c Trp-ADP-AuNCs
d Trp-ADP-AuNCs after 120
Fluorescence Intensity (a.u.)
Wavelength (nm)
0
100
200
300
400
500
600
700
300
350
400
450
500
550
600

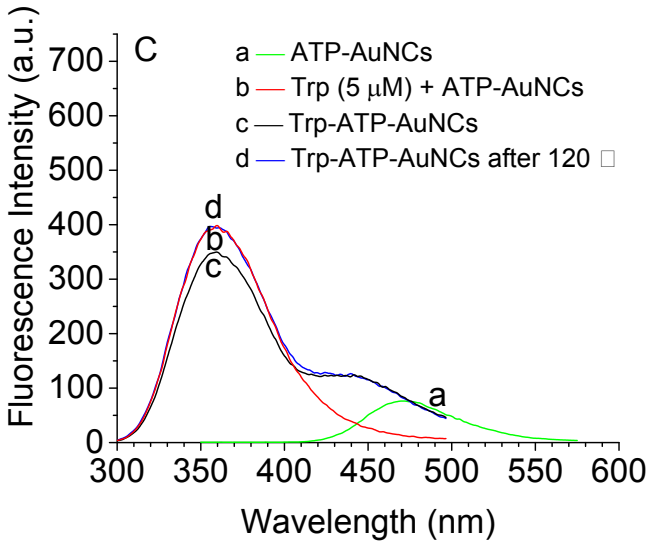


Figure S14. Fluorescence spectra of Trp-AMP-AuNCs (A), Trp-ADP-AuNCs (B) and Trp-ATP-AuNCs (C) before (b) and after (c) a hydrothermal reaction, and after a treatment of 120 ℃ (d). The concentrations of these AuNC solutions: In A: AMP-AuNCs (985 μg/L), Trp (5 μM) + AMP-AuNCs (49.25 μg/L), Trp-AMP-AuNCs (49.25 μg/L); In B: ADP-AuNCs (985 μg/L), Trp (5 μM) + ADP-AuNCs (49.25 μg/L), Trp-ADP-AuNCs (49.25 μg/L); In C: ATP-AuNCs (985 μg/L), Trp (5 μM) + ATP-AuNCs (49.25 μg/L), Trp-ATP-AuNCs (49.25 μg/L).

Figure S15

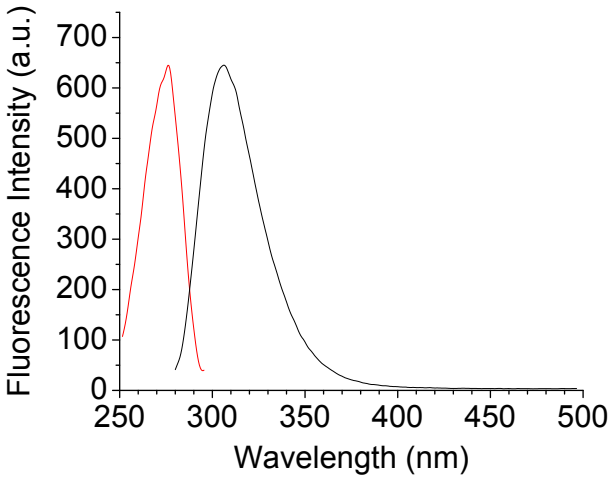


Figure S15. Emission (black) and excitation (red) spectra of tyrosine solution (40 μM). Excitation wavelength for the emission spectrum and observed wavelength for the excitation spectrum are 275 and 306 nm, respectively.

Figure S16

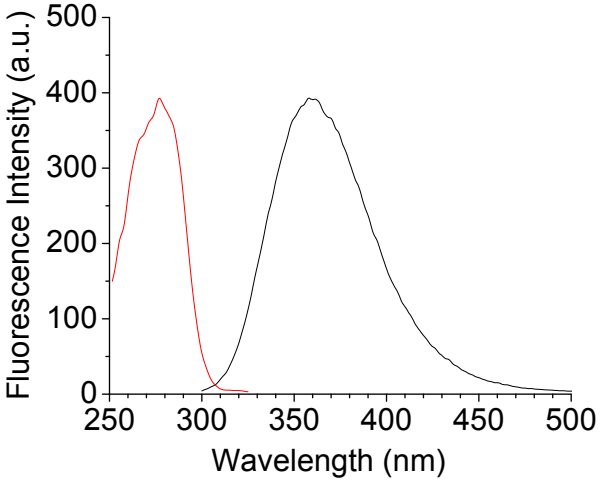
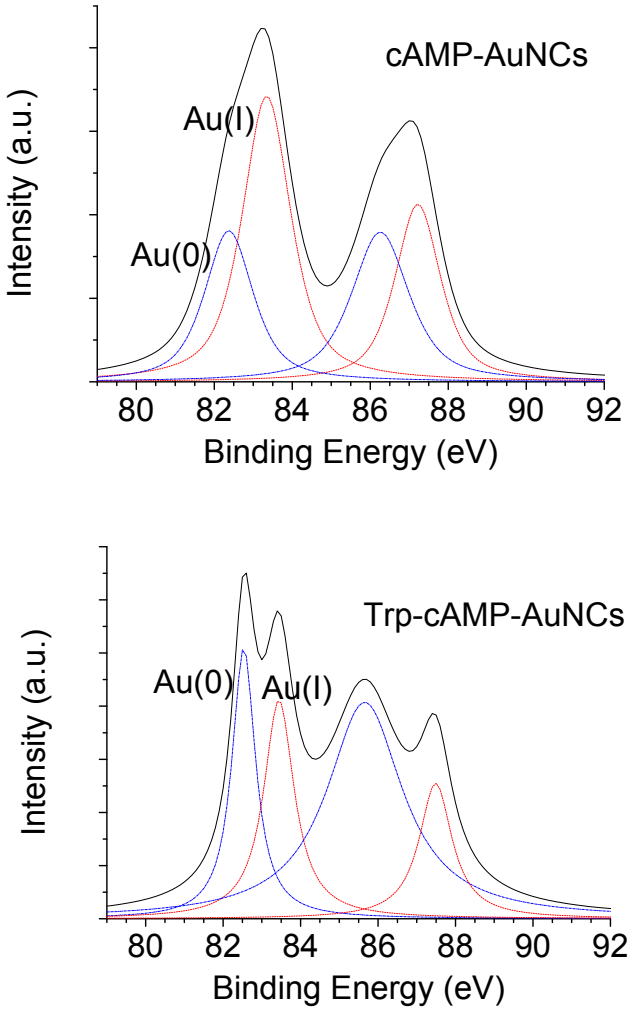


Figure S16. Emission (black) and excitation (red) spectra of tryptamine solution (2.5 μM). Excitation wavelength for the emission spectrum and observed wavelength for the excitation spectrum are 277 and 358 nm, respectively.

Figure S17



	Au(0)		Au(I)	
	binding energy for Au $4f_{7/2}$ (eV)	proportion	binding energy for Au $4f_{7/2}$ (eV)	proportion
cAMP-AuNCs	82.3	34.4 %	83.3	65.6 %
Trp-cAMP-AuNCs	82.5	49.0 %	83.5	51.0 %

Figure S17. XPS spectra of cAMP-AuNCs and Trp-cAMP-AuNCs.