

Electronic Supplementary Information

The light-up fluorescence of AgNCs in a “DNA bulb”

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Table S1. Names and sequences of the oligonucleotides used in this work.

No.	Name ("filament" ssDNA)	Sequence (5'-3') ("filament" is the central sequence with red color)
1	B-L	ATTACAGCTTGCTACACGAGAAGAGCCGCCATAGTA
2	B-R	TATCACCAGGCAGTTGACAGTGTAGCAAGCTGTAAT
3	B-F0	TCAACTGCCTGGTGATAAAACGACACTACGTGGGAATCTACTATGGCGGCTCTTC
4	B-F1 / C7(12)	TCAACTGCCTGGTGATAACCTTAATCCCCCTACTATGGCGGCTCTTC
5	B-F2 / C6(24)	TCAACTGCCTGGTGATATGACTAAATTAACCTTAATTACCTACTATGGCGGCTCTTC
6	B-F3 / C8(24)	TCAACTGCCTGGTGATATGACTAAAAACCTTAATCCCCCTACTATGGCGGCTCTTC
7	B-F4 / C13(24)	TCAACTGCCTGGTGATAAGTACCCCAACCTGCCCTACCCTACTATGGCGGCTCTTC
8	B-F5 / C14(24)	TCAACTGCCTGGTGATAACCTTAATCCCCCCTTAATCCCCCTACTATGGCGGCTCTTC
9	B-F6 / C16(24)	TCAACTGCCTGGTGATACTCCTTCCTCCCTCCTCCTCCTCCTACTATGGCGGCTCTTC
10	B-F7 / C19(24)	TCAACTGCCTGGTGATACTCCTCCCCCCTTCCCCCTCCCTACTATGGCGGCTCTTC
11	B-F8 / C21(24)	TCAACTGCCTGGTGATACCCCCTCCCCCCTCCCCCTCCCTACTATGGCGGCTCTTC
12	B-F9 / C24(24)	TCAACTGCCTGGTGATACCCCCCCCCCCCCCCCCCCCCTACTATGGCGGCTCTTC
13	B-F10 / C8(8)	TCAACTGCCTGGTGATACCCCCCCCCTACTATGGCGGCTCTTC
14	B-F11 / C8(12)	TCAACTGCCTGGTGATACTCCTTCCTCCTACTATGGCGGCTCTTC
15	B-F12 / C8(16)	TCAACTGCCTGGTGATACTCCTTATCTACTCCTACTATGGCGGCTCTTC
16	B-F13 / C8(20)	TCAACTGCCTGGTGATACTCCTTAATTCTTAACTCCTACTATGGCGGCTCTTC
17	B-F3 / C8(24)	TCAACTGCCTGGTGATATGACTAAAAACCTTAATCCCCCTACTATGGCGGCTCTTC
19	B-L-AT	ATTACAGCTTGCTACACGAAAAACGTTATTATAATA
17	B-R-AT	TATTATCGAATAATTAACAGTGTAGCAAGCTGTAAT
18	BAT-F0	TTAATTATTCGATAATAAAACGACACTACGTGGGAATCTATTATAATAACGTTTT
19	B-L-GC	ATTACAGCTTGCTACACGAGGGGATCCGCCGCGGCG
20	B-R-GC	CGCCGCATGGCGGCCGCGAGTGTAGCAAGCTGTAAT
21	BGC-F0	CCGGCCGCCATGCGGCGAAACGACACTACGTGGGAATCCGCCGCGGCGGATCCCC

Table S2. The reported DNA concentrations, buffer conditions and molar ratios (DNA template: [Ag⁺]) used for syntheses of AgNCs.

DNA concentration	[DNA] : [Ag ⁺]	Buffer condition	Reference
0.5 μM	1:10	phosphate buffer (20 mM, pH 7.4)	<i>Nanoscale</i> , 2015, 7, 13224–13229.
1.0 μM	1:12	Tris buffer (30 mM, pH 7.0)	<i>Analyst</i> , 2017, 142, 1765–1771.
1.0 μM	1:6	phosphate buffer (20 mM, pH 7.4)	<i>Chem. Sci.</i> , 2018, 9, 1774–1781.
1.5 μM	1:17	unknown	<i>Anal. Chem.</i> , 2011, 83, 6935–6939.
2.0 μM	1:12	citrate buffer (20 mM, pH 7.0)	<i>Small</i> , 2015, 11, 1385–1389.
2.5 μM	1:6	phosphate buffer saline (20 mM, pH 7.0)	<i>Talanta</i> , 2018, 181, 24-31.
3.0 μM	1:6	phosphate buffer (20 mM, pH 6.6)	<i>Chem. Commun.</i> , 2012, 48, 5488–5490.
5.0 μM	1:8	phosphate buffer (20 mM, pH 7.4)	<i>Biosens. Bioelectron.</i> , 2016, 79, 411–415.
10 μM	1:6	phosphate buffer (5 mM, pH 7.5)	<i>J. Am. Chem. Soc.</i> , 2004, 126, 5207–5212.
15 μM	1:16	formate/cacodylate/phosphate/borate buffer (10 mM, pH 6-9)	<i>J. Phys. Chem. C</i> , 2009, 113, 19518–19524.
15 μM	1:6	phosphate buffer (20 mM, pH 6.6)	<i>Nano Lett.</i> , 2010, 10, 3106–3110.
15 μM	1:6	phosphate buffer (20 mM, pH 6.6)	<i>Chem. Commun.</i> , 2010, 46, 3280–3282.
25 μM	1:6	ammonium acetate buffer (40 mM, pH 7.0)	<i>J. Phys. Chem. C</i> , 2009, 113, 4229–4233.
25 μM	1:9	phosphate buffer (200 mM, pH7.0)	<i>Chem. Commun.</i> , 2018, 54, 1089–1092.
30 μM	1:6	ammonium acetate buffer (40 mM, pH 7.0)	<i>Chem. Commun.</i> , 2009, 23, 3395–3397.
50 μM	1:6	phosphate/citrate/ammonium buffer (20 mM, pH 5-8)	<i>J. Am. Chem. Soc.</i> , 2008, 130, 5038–5039.
50 μM	1:6	phosphate buffer (20 mM, pH 7.4, 100 mM KCl)	<i>Talanta</i> , 2012, 88, 450–455.
50 μM	1:6	phosphate buffer (20 mM, pH 7.0)	<i>Anal. Chem.</i> , 2018, 90, 1098–1103.
60 μM	1:6	18-MΩ water (pH 7.0)	<i>PNAS</i> , 2007, 104, 12616–12621.
10 mM	1:6	phosphate-buffered saline (10 mM, pH=7.4)	<i>Chem. Commun.</i> , 2015, 51, 11810–11813.

Table S3. The fluorescence intensities of B-F_x-AgNCs (AgNCs synthesized with “filament” ssDNA) and B_x-AgNCs (AgNCs synthesized with complete “DNA bulb”) at the maximum emission wavelengths, and the enhancing index (FI₁/FI₀).

“filament”-AgNCs	FL Intensity (FI ₀)	“bulb”-AgNCs	FL Intensity (FI ₁)	Maximum Emission Wavelength	Enhancing Index (FI ₁ /FI ₀)
B-F0-AgNCs	693.791	B0-AgNCs	15403.637	530 nm	22.2
B-F1-AgNCs	1123.7	B1-AgNCs	3232.7	527 nm	2.9
B-F2-AgNCs	1024.475	B2-AgNCs	2328.129	548 nm	2.3
B-F3-AgNCs	1500.606	B3-AgNCs	2952.635	549 nm	2.0
B-F4-AgNCs	680.9	B4-AgNCs	29724.1	645 nm	43.7
B-F5-AgNCs	756.2	B5-AgNCs	14622.8	576 nm	19.3
B-F6-AgNCs	4957.6	B6-AgNCs	30768.6	652 nm	6.2
B-F7-AgNCs	28932.271	B7-AgNCs	40087.793	707 nm	1.4
B-F8-AgNCs	24178.684	B8-AgNCs	30599.3	682 nm	1.3
B-F9-AgNCs	321.9	B9-AgNCs	56393.5	546 nm	175.2
B-F10-AgNCs	9128.038	B10-AgNCs	18030.635	729 nm	2.0
B-F11-AgNCs	863.708	B11-AgNCs	3126.047	638 nm	3.6
B-F12-AgNCs	818.671	B12-AgNCs	2478.688	628 nm	3.0
B-F13-AgNCs	897.763	B13-AgNCs	2227.973	623 nm	2.5
BAT-F0-AgNCs	335.66	BAT-AgNCs	10231.159	530 nm	30.5
BGC-F0-AgNCs	7165.037	BGC-AgNCs	21239.309	651 nm	3.0

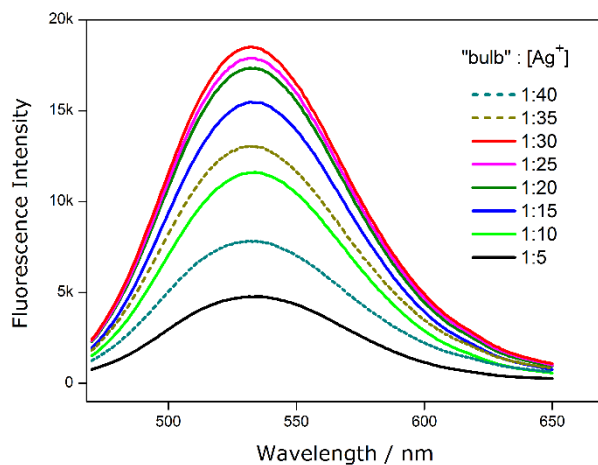


Figure S1. Fluorescence spectrum of B0-AgNCs as a function of [DNA bulb]:[Ag⁺] ratio. The decreases when using 1:35 and 1:40 were supposed to be formation of larger nonluminous silver particles.

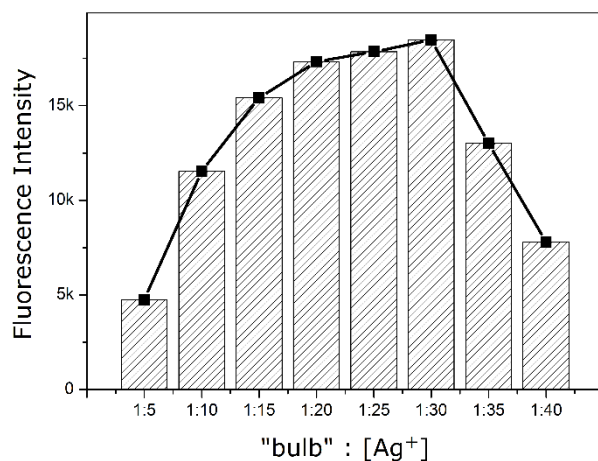


Figure S2. Fluorescence intensity at 530 nm of B0-AgNCs as a function of [DNA bulb]:[Ag⁺] ratio.

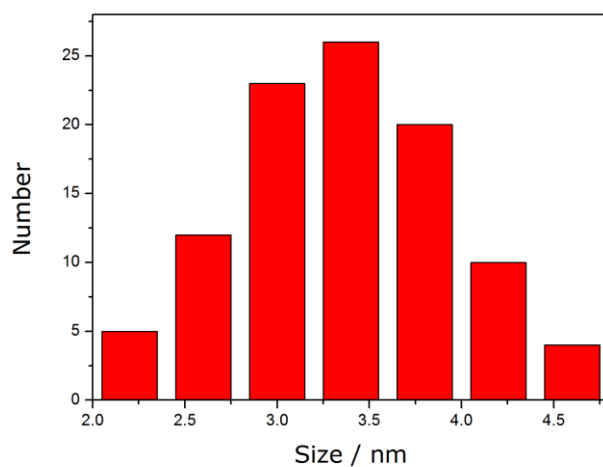


Figure S3. Statistical analysis of B0-AgNCs size by measuring 100 particles using the ImageJ software.

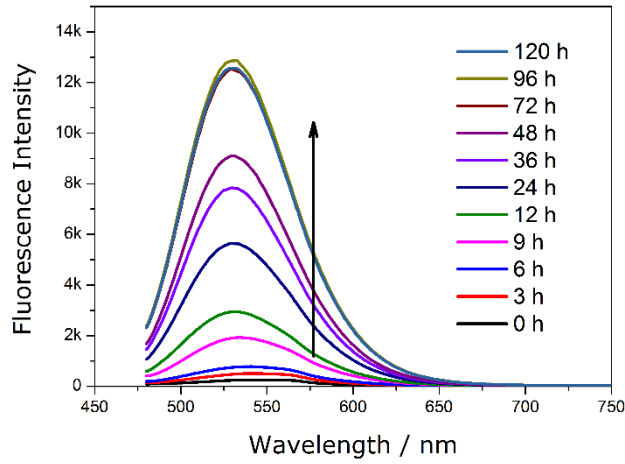


Figure S4. The time-dependent fluorescence spectra during the formation of B0-AgNCs. The samples were placed in a dark place at room temperature during each measurement interval.

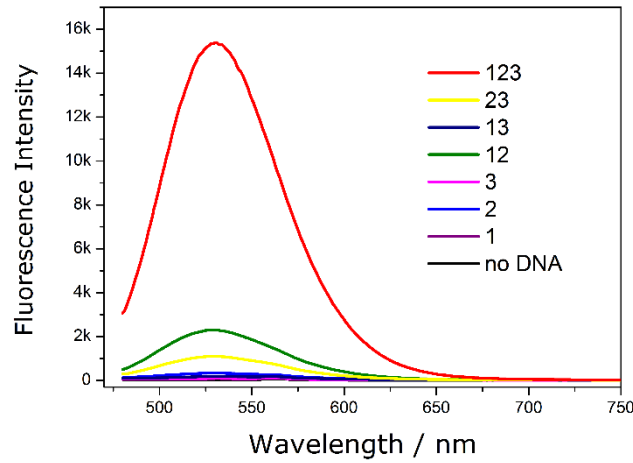


Figure S5. Fluorescent spectra of synthesized AgNCs capped with different ssDNA combinations. 1: B-L, 2: B-R, 3: B-F0 (Table S1).

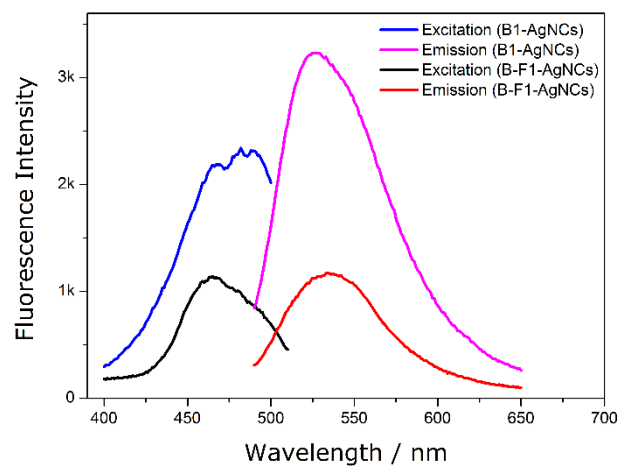


Figure S6. Excitation and emission spectra of B-F1-AgNCs and B1-AgNCs, respectively. B1 represented “bulb” 1, which was assembled by B-L&B-R&B-F1.

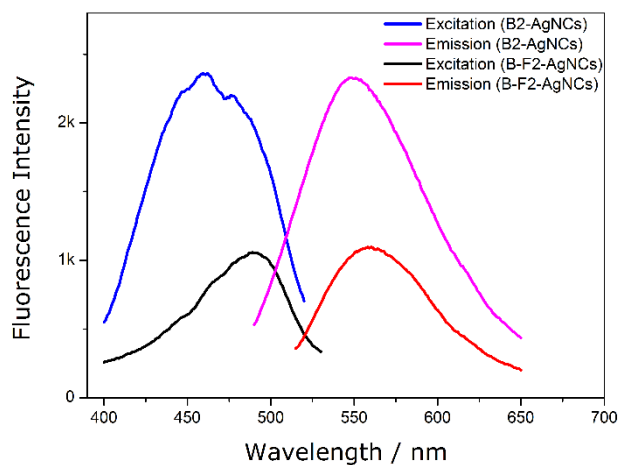


Figure S7. Excitation and emission spectra of B-F2-AgNCs and B2-AgNCs, respectively. B2 represented “bulb” 2, which was assembled by B-L&B-R&B-F2.

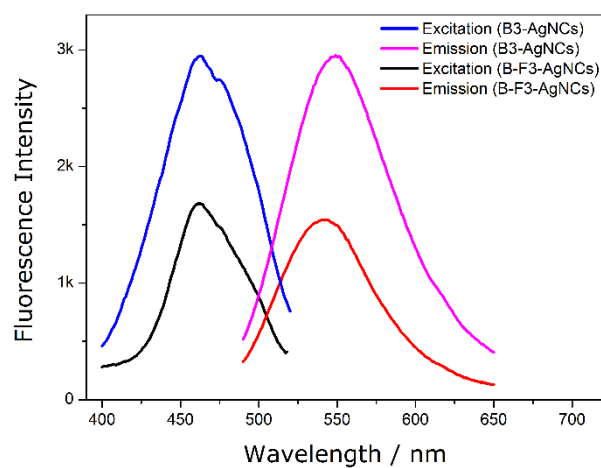


Figure S8. Excitation and emission spectra of B-F3-AgNCs and B3-AgNCs, respectively.

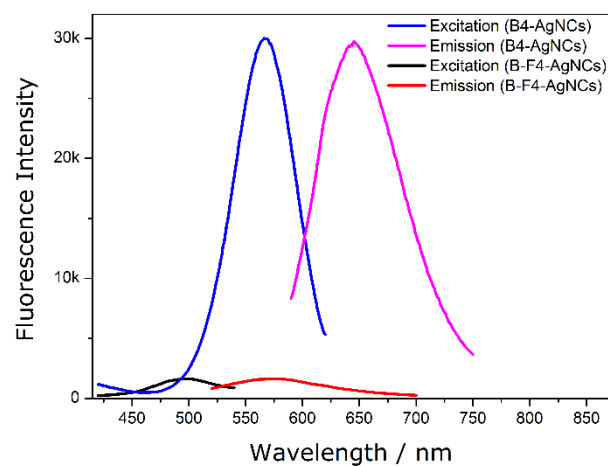


Figure S9. Excitation and emission spectra of B-F4-AgNCs and B4-AgNCs, respectively.

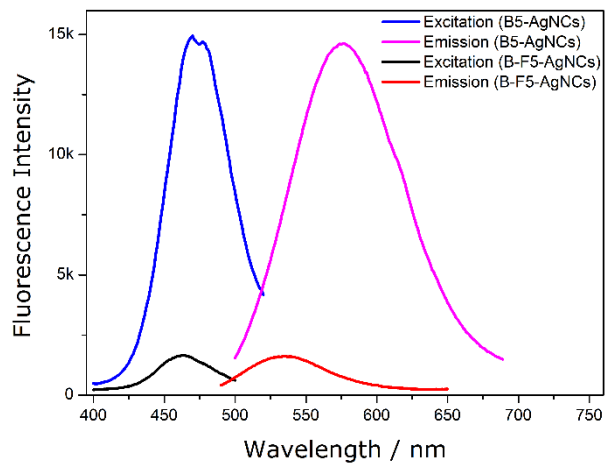


Figure S10. Excitation and emission spectra of B-F5-AgNCs and B5-AgNCs, respectively.

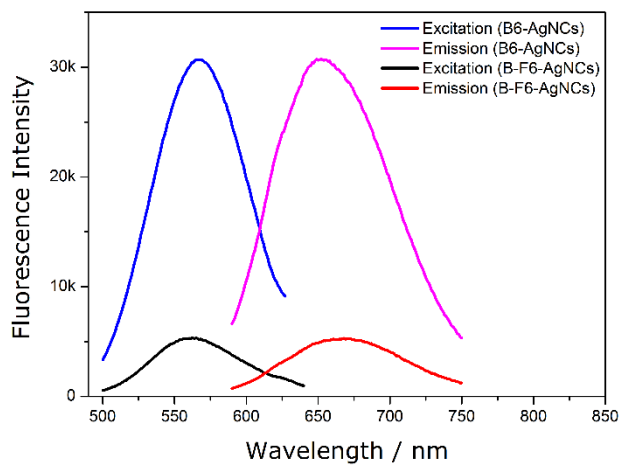


Figure S11. Excitation and emission spectra of B-F6-AgNCs and B6-AgNCs, respectively.

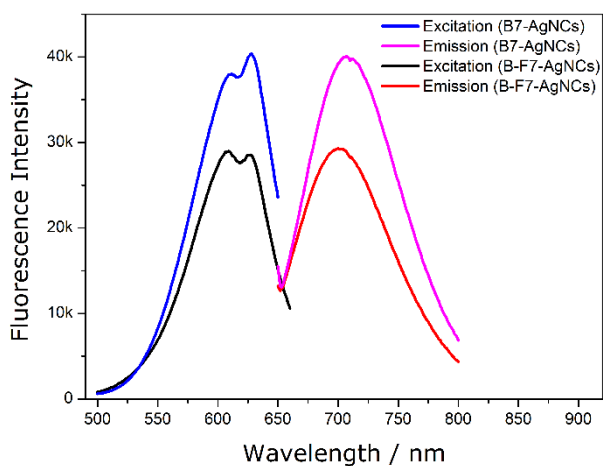


Figure S12. Excitation and emission spectra of B-F7-AgNCs and B7-AgNCs, respectively.

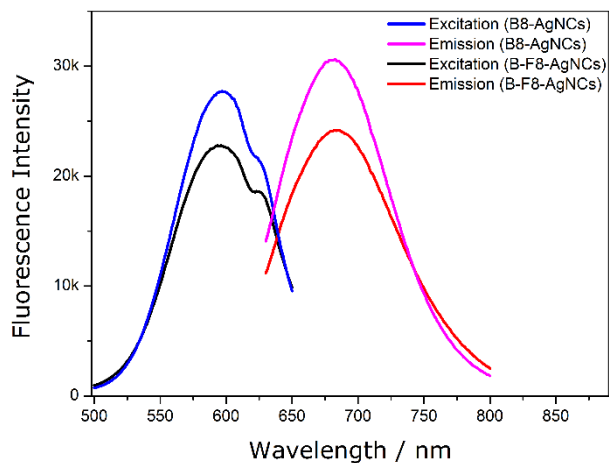


Figure S13. Excitation and emission spectra of B-F8-AgNCs and B8-AgNCs, respectively.

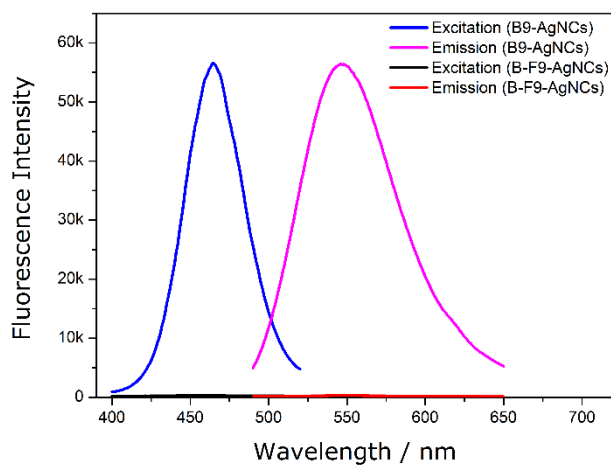


Figure S14. Excitation and emission spectra of B-F9-AgNCs and B9-AgNCs, respectively.

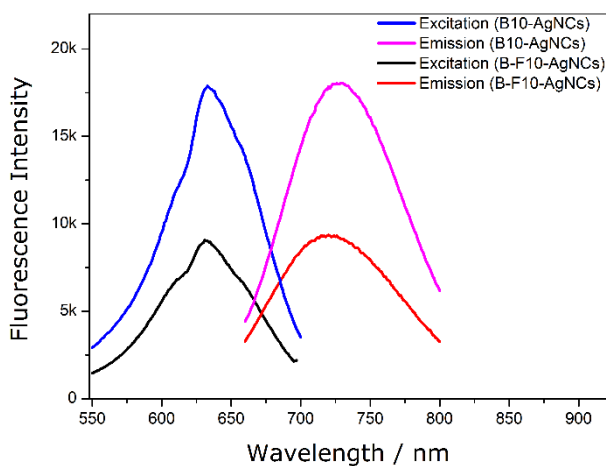


Figure S15. Excitation and emission spectra of B-F10-AgNCs and B10-AgNCs, respectively.

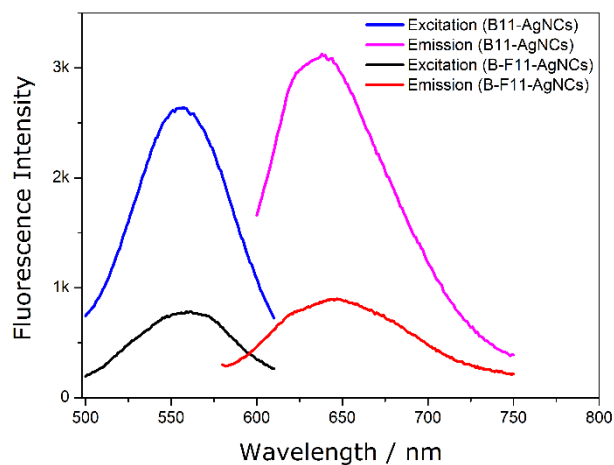


Figure S16. Excitation and emission spectra of B-F11-AgNCs and B11-AgNCs, respectively.

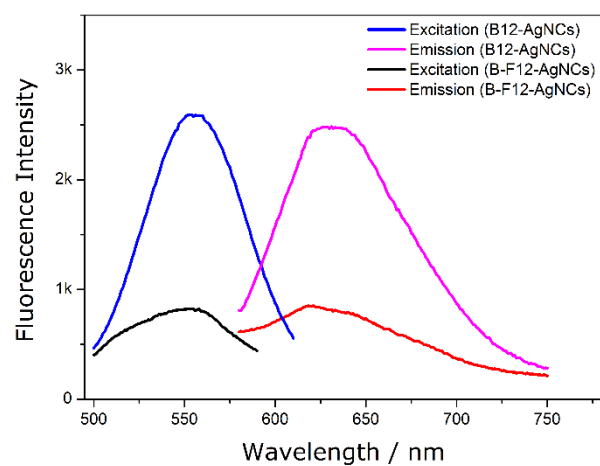


Figure S17. Excitation and emission spectra of B-F12-AgNCs and B12-AgNCs, respectively.

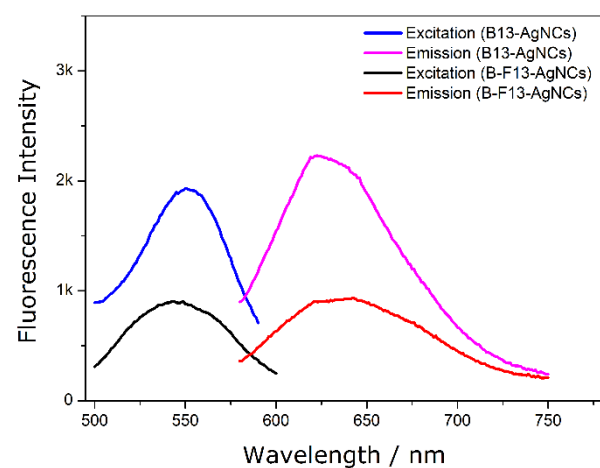


Figure S18. Excitation and emission spectra of B-F13-AgNCs and B13-AgNCs, respectively.

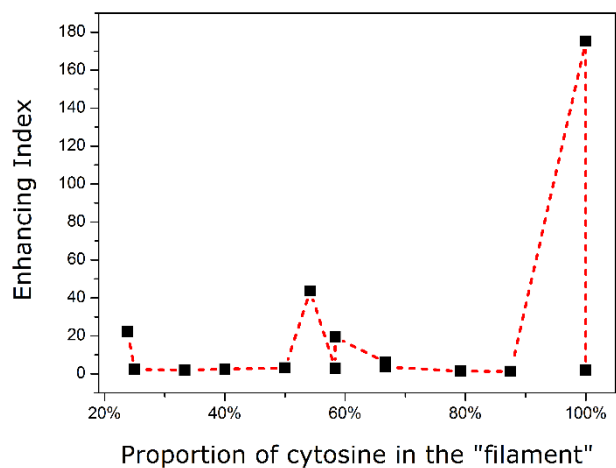


Figure S19. The correlation between enhancing index and proportion of cytosine in the “filament”.

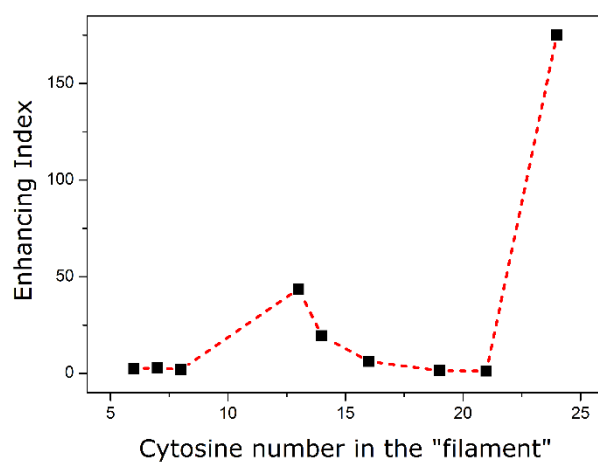


Figure S20. The relationship between enhancing index and the number of cytosine bases in the “filament”.

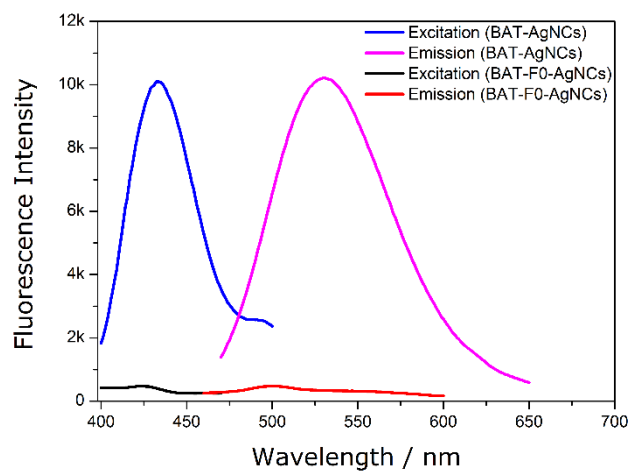


Figure S21. Excitation and emission spectra of BAT-F0-AgNCs and BAT-AgNCs, respectively.

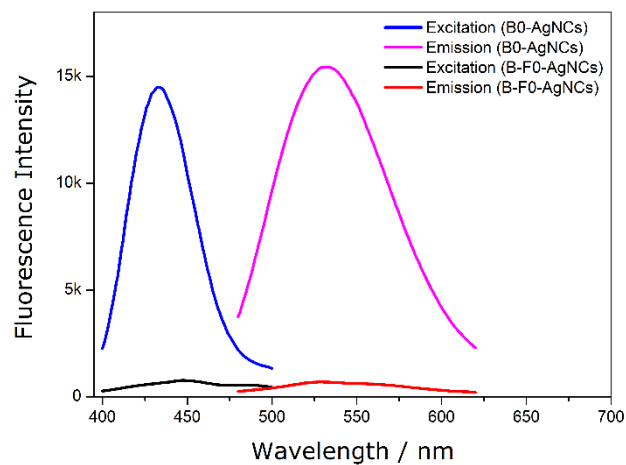


Figure S22. Excitation and emission spectra of B-F0-AgNCs and B0-AgNCs, respectively.

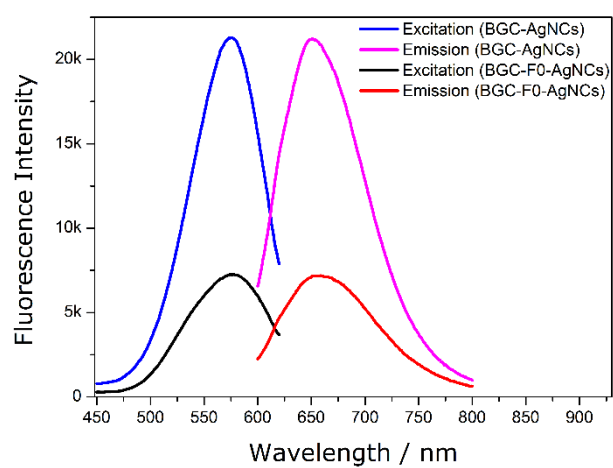


Figure S23 Excitation and emission spectra of BGC-F0-AgNCs and BGC-AgNCs, respectively.

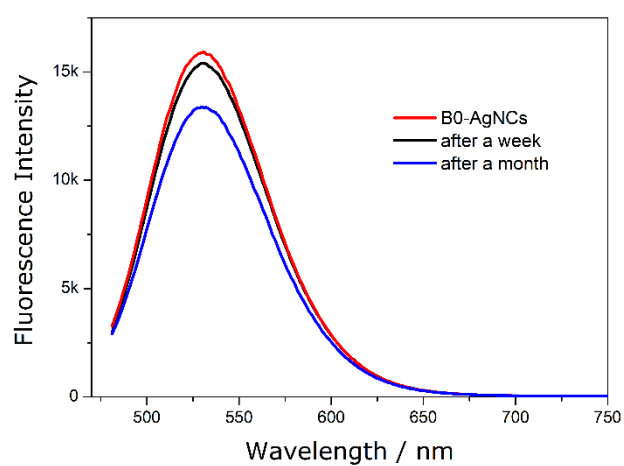


Figure S24. Fluorescence spectra of B0-AgNCs recorded at set intervals (stored at room temperature in darkness).

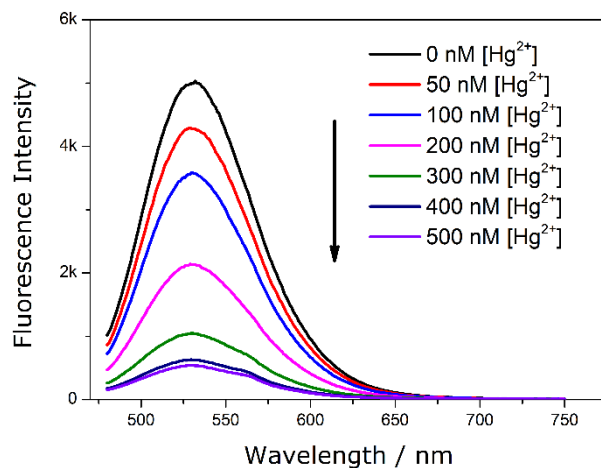


Figure S25. Emission spectra of B0-AgNCs in the presence of different concentration of Hg^{2+} .

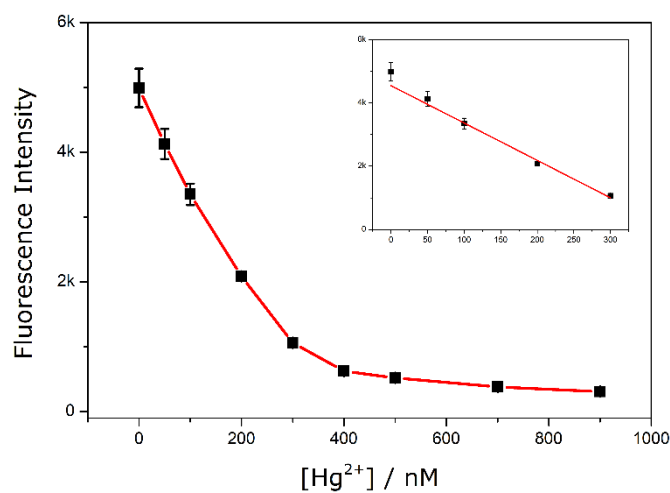


Figure S26. Fluorescence intensity changes of B0-AgNCs as a function of the concentration of Hg^{2+} . The inset is a linear relationship between the change of fluorescence intensity and concentration of Hg^{2+} (0–300 nM).

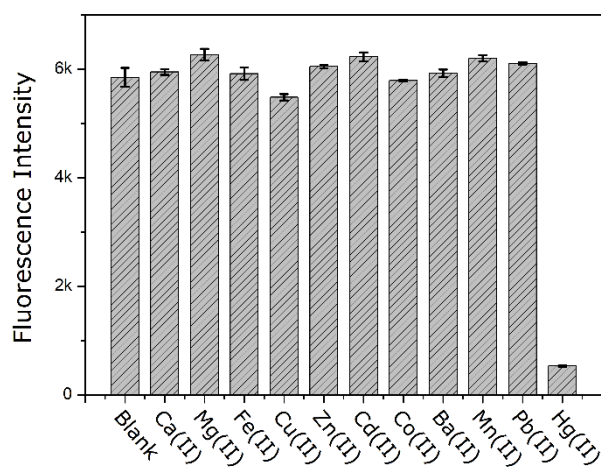


Figure 27. Fluorescence intensity at $\lambda_{em}=530$ nm of aqueous B0-AgNCs solutions in the presence of different metal ions (5 μM except Hg^{2+} 500 nM).