

Supplementary Materials

A novel Cu²⁺ quantitative detection nucleic acid biosensors based on DNAzyme and “blocker” beacon

Table S1 Absorbance: Optimized of copper ion cutting conditions (Figure 2C Original data)

	Data 1	Data 2	Data 3
1: 1.5 M NaCl, 50 mM HEPES, pH 7.0;	0.178	0.184	0.181
2: HEPES 100 mM, pH 7.0, 0.008% (V/V) Triton X-100 and 400 mM NaCl	0.191	0.194	0.198
3: Ultrapure water	0.451	0.444	0.431

Table S2 Absorbance: Optimization of chromogenic ionic conditions (Figure 2D Original data)

	Data 1	Data 2	Data 3
1: 1.5 M NaCl, 50 mM HEPES, pH 7.0;	0.351	0.343	0.349
2: HEPES 100 mM, pH 7.0, 0.008% (V/V) Triton X-100 and 400 mM NaCl	0.553	0.553	0.551
3: 10 mM Tris-HCl pH 7.4, 10 mM KCl, 100 mM NaCl, 0.002% (V/V) TritonX-100;3: Ultrapure water	0.143	0.145	0.141
4: 10 mM Tris-HCl (pH 8.0), 0.002% (V/V) Tri-tonX-100, 1.6 mM KCl, 0.8 mM MgCl₂;	0.231	0.227	0.224
5: 50 mM NaCl, 10 mM Tris-HCl (pH 7.9), 10 mM DTT, 10 mM MgCl₂;	0.065	0.061	0.064
6: Ultrapure water	0.187	0.194	0.191

Table S3 Absorbance: Optimization of the concentration of H₂O₂ (Figure 2E Original data)

Concentrations of H ₂ O ₂	Data 1	Data 2	Data 3
0.25 mM	0.35	0.324	0.345
1 mM	0.55	0.532	0.543
1.5 mM	0.425	0.412	0.418
2.5 mM	0.275	0.271	0.264
5 mM	0.25	0.234	0.245

Table S4 Absorbance: Optimization of the ratio of Cu-Enz and Cu-Su (Figure 2F Original data)

The ratio of Cu-Enz to Cu-Sub	Data 1	Data 2	Data 3
1:1	0.35	0.341	0.345
1:3	0.347	0.341	0.341
1:5	0.334	0.321	0.317
1:10	0.311	0.314	0.315
1:15	0.301	0.304	0.3

Table S5 Absorbance ($\lambda = 419$ nm) under different Cu^{2+} concentrations (Figure 3B, 3C Original data)

The concentrations of Cu^{2+}	Data 1	Data 2	Data 3
0 Nm	0.56	0.562	0.563
31.25 nM	0.543	0.543	0.543
62.5 nM	0.537	0.537	0.537
125 nM	0.53	0.53	0.53
250 nM	0.507	0.509	0.511
500 nM	0.48	0.48	0.48
1 μM	0.455	0.45	0.451
4 μM	0.445	0.441	0.448
8 μM	0.426	0.428	0.425
12 μM	0.381	0.384	0.383
16 μM	0.324	0.323	0.321
50 μM	0.301	0.304	0.306
100 μM	0.276	0.266	0.273

Table S6 Absorbance: The change of absorbance (ΔAbs) of the turn-off sensor after adding different metal ions (Figure 4A Original data)

	Data 1	Data 2	Data 3
Cu²⁺	0.164	0.165	0.161
Fe³⁺	0.021	0.021	0.018
Fe²⁺	0.016	0.017	0.016
Al³⁺	0.015	0.013	0.016
Ca²⁺	0.024	0.021	0.024
Pb²⁺	0.016	0.016	0.014
Mn²⁺	0.02	0.021	0.024
Zn²⁺	0.022	0.021	0.021
Li⁺	0.021	0.02	0.021
Mg²⁺	0.024	0.024	0.027

Table S7 Determination of Cu²⁺ in four different water sample using the biosensor and ICP-MS.
(Table2 Original data)

	Concentrations (μM)	This method				ICP-MS		
		Data 1	Data 2	Data 3	RSD	Data 4	Data 5	Data 6
Dianchi lake	C1	0.208	0.227	0.225	4.75	0.225	0.227	0.232
	C2	0.106	0.098	0.096	5.29	0.102	0.098	0.1
	C3	0.329	0.304	0.309	4.21	0.316	0.315	0.32
Cuihu lake	C1	0.170	0.174	0.193	6.86	0.182	0.187	0.183
	C2	0.102	0.105	0.093	6.24	0.102	0.098	0.100
	C3	0.265	0.270	0.290	4.84	0.283	0.279	0.279

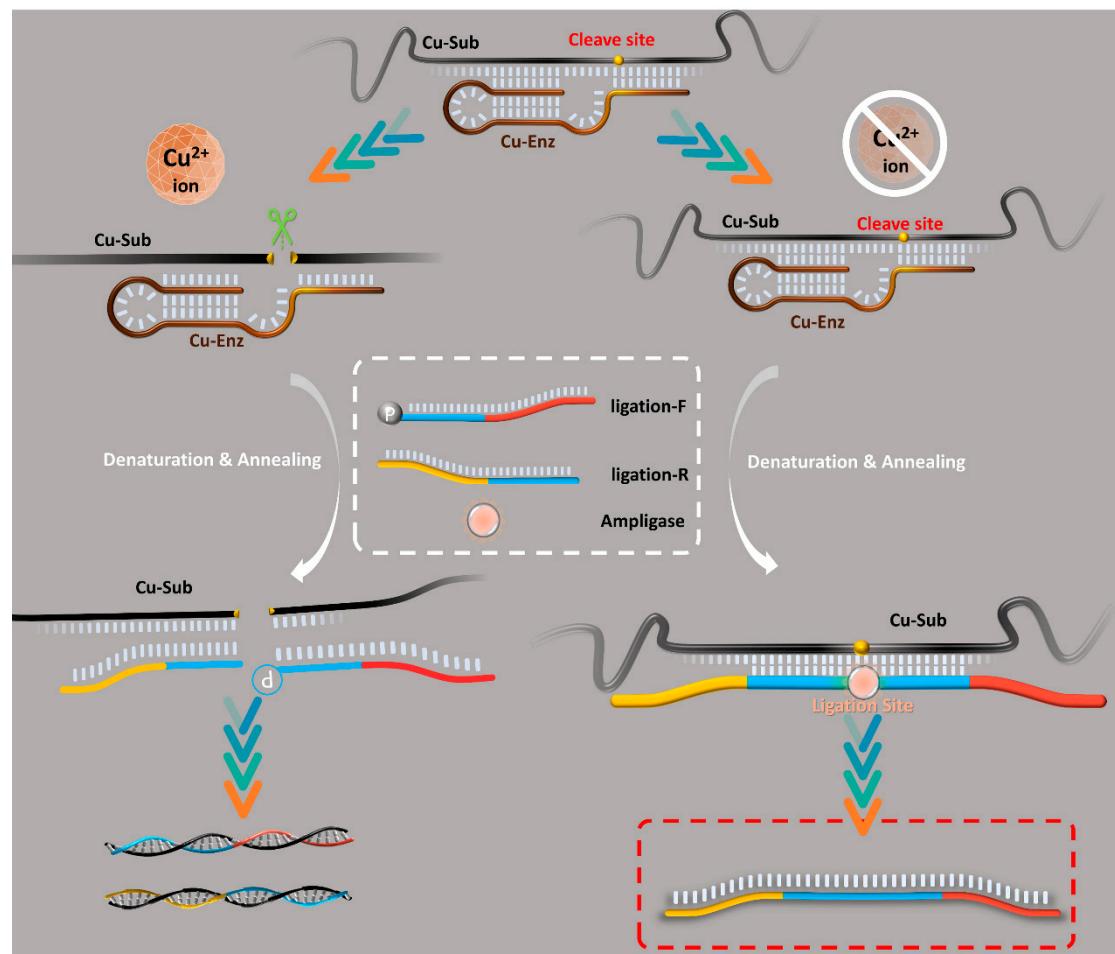


Figure S1: The Original size of Scheme1A

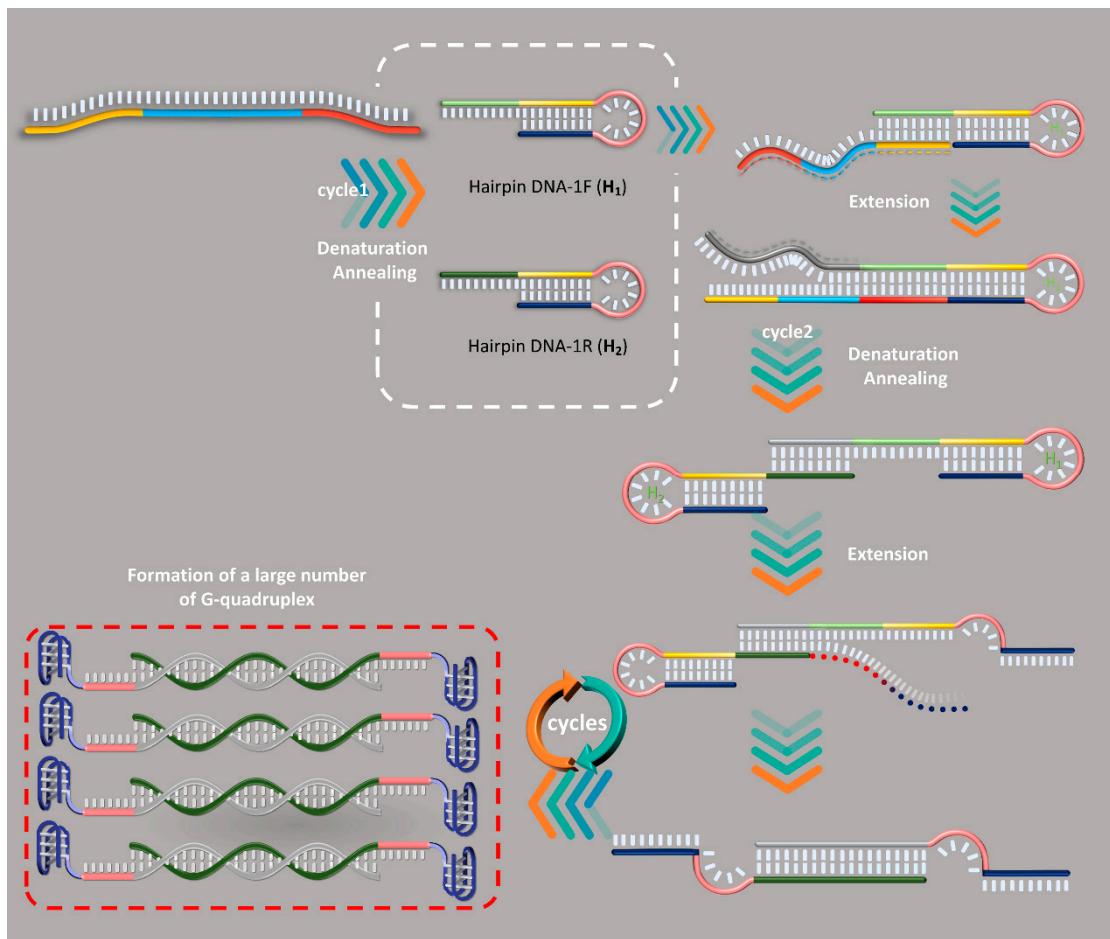


Figure S2: The Original size of Scheme1B

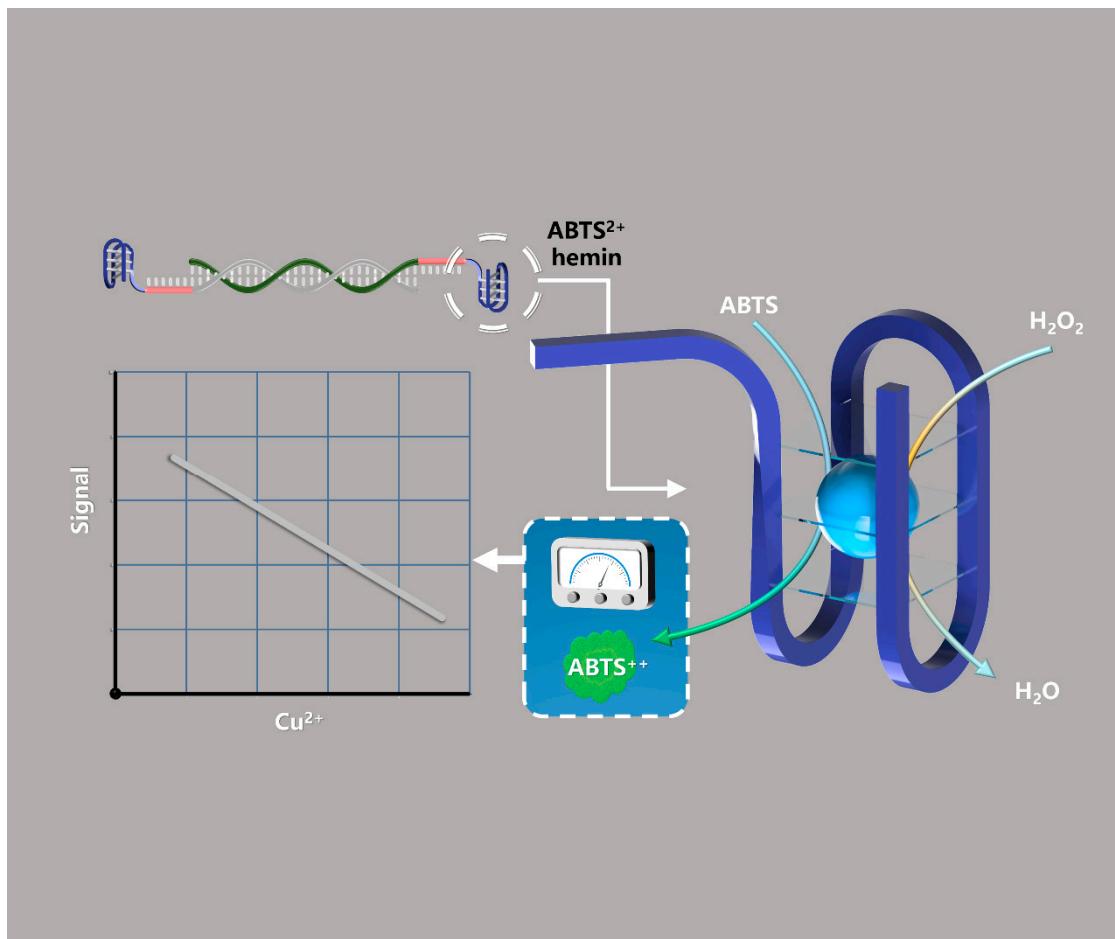


Figure S3: The Original size of Scheme1C