Supporting information

Iodide-responsive Cu-Au nanoparticles-based colorimetric sensor array for discrimination of proteins

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12 pages; 6 tables, and 4 figures

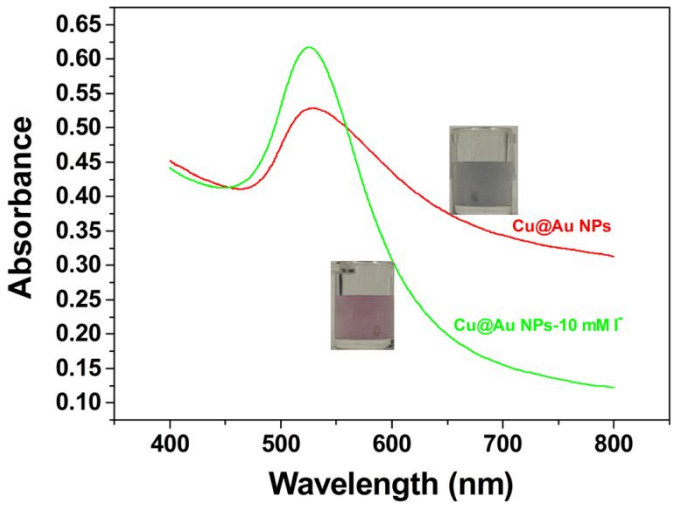

Fig. S1 Photos and UV-vis absorption spectra of the Cu-Au NP solution in the absence and presence of 10 mM iodide.

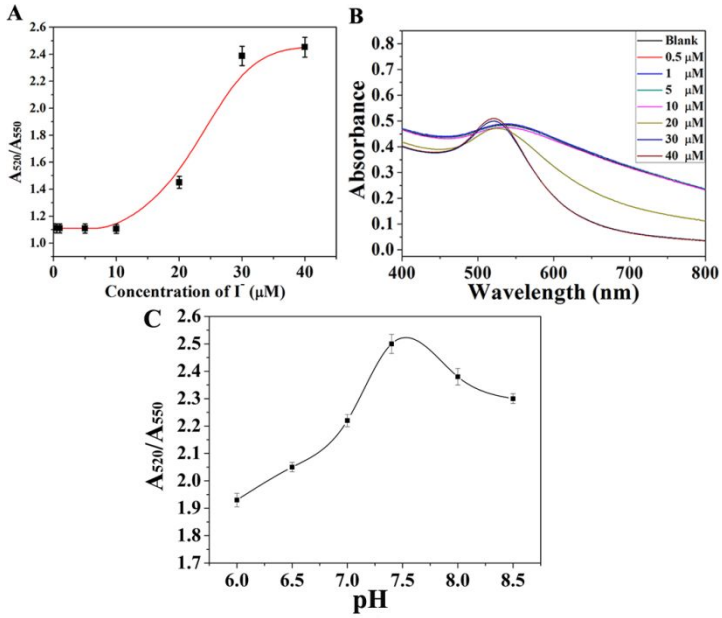

Fig. S2 (A) The $A_{520\ nm}/A_{550\ nm}$ ratio as a function of iodide concentration; (B) Absorption profiles of Cu-Au NPs solution (pH 7.4) after interaction with different concentrations of iodide ion for 25 min. (C) The $A_{520\ nm}/A_{550\ nm}$ ratio as a function of solution pH.

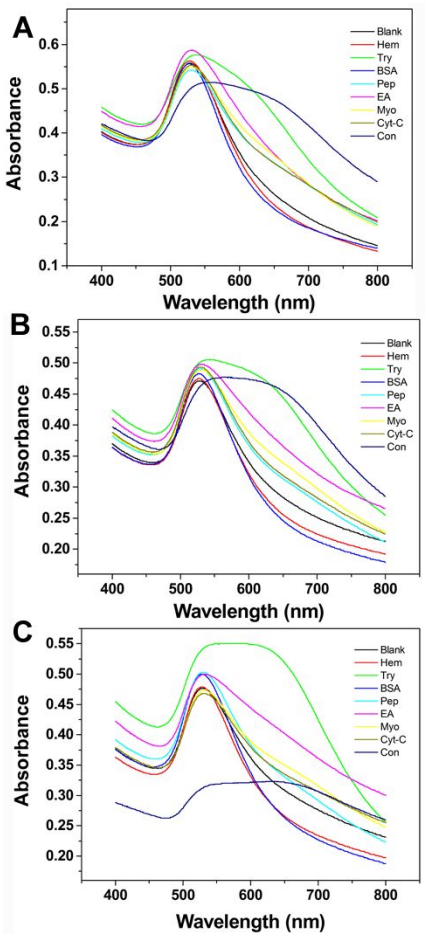

Fig. S3 UV-vis absorption spectra of the Cu-Au NP solution in the absence and presence of 8 proteins at 20 nM in the presence of (A) 15A, (B) 15C, and (C) 15 T, respectively.

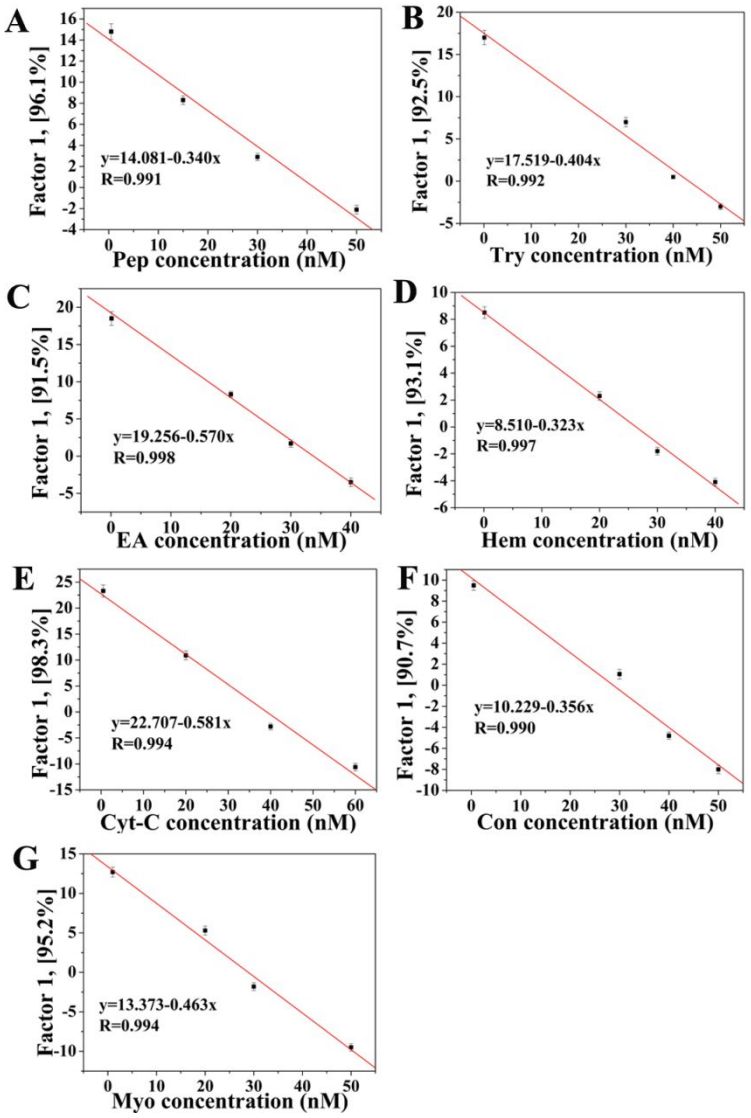

Fig. S4 Plot of the discriminant factor 1 versus (A) Pep, (B) Try, (C) EA, (D) Hem, (E) Cyt-C, (F) Con, and (G) Myo concentrations.

Table S1. The training matrix of the colorimetric response patterns against the eight proteins at 20 nM using this sensor assay.

proteins	UV-15A	UV-15C	UV-15T
Hem	0.849	0.861	0.902
Hem	0.848	0.898	0.880
Hem	0.854	0.934	0.890
Hem	0.877	0.916	0.901
Hem	0.861	0.909	0.875
Try	0.999	1.006	0.947
Try	1.060	0.993	0.968
Try	0.997	0.983	0.955
Try	0.985	1.007	0.973
Try	0.990	1.024	0.971
BSA	0.647	0.704	0.606
BSA	0.656	0.686	0.654
BSA	0.640	0.672	0.607
BSA	0.620	0.668	0.651
BSA	0.579	0.662	0.630
Pep	1.050	1.018	0.988
Pep	1.046	1.023	0.993
Pep	1.032	1.020	1.007
Pep	1.048	1.040	0.986
Pep	0.025	1.027	1.037
EA	0.789	0.798	0.739
EA	0.781	0.792	0.750
EA	0.777	0.795	0.730
EA	0.770	0.804	0.734
EA	0.785	0.782	0.729
Myo	0.788	0.814	0.775
Myo	0.792	0.811	0.811
Myo	0.786	0.805	0.799
Myo	0.784	0.816	0.797
Myo	0.779	0.808	0.784
Cyt-C	0.753	0.872	0.828
Cyt-C	0.776	0.887	0.823
Cyt-C	0.761	0.884	0.797
Cyt-C	0.784	0.863	0.789
Cyt-C	0.760	0.862	0.788
Con	0.591	0.542	0.690
Con	0.556	0.511	0.644
Con	0.529	0.495	0.641

Con	0.566	0.551	0.630
Con	0.519	0.586	0.690

Table S2 The RSDs for results from the sensor array for each protein at 20 nM.

protein	BSA	Con	Hem	Myo	EA	Cyt-C	Try	Pep
RSD (%)	5.98	5.51	5.39	3.90	3.74	4.01	3.58	3.27

Table S3. Comparison of different sensor arrays for protein discrimination based on NPs.

method	receptors	the number of identified proteins	limit of detection (nM)	ref.
colorimetric	DNA	7	50	[18]
colorimetric and fluorescence	DNA	11	50	[19]
colorimetric	Fe_3O_4 NPs	10	50	[3]
fluorescent	Au nanodots	8	25	[12]
colorimetric	gold nanoclusters	8	50	[29]
fluorescent	aptamers	9	20	[14]
colorimetric	DNA	10	50	[30]
colorimetric	DNA	8	20	this work

Table S4. The training matrix of the colorimetric response patterns against BSA with various concentrations (0.1-50 nM) using this sensor assay.

concentration	UV-15A	UV-15C	UV-15T
0.1 nM	0.694	0.644	0.728
0.1 nM	0.695	0.637	0.739
0.1 nM	0.655	0.661	0.366
0.1 nM	0.669	0.647	0.724
0.1 nM	0.690	0.648	0.718
30 nM	0.543	0.619	0.627
30 nM	0.567	0.625	0.626
30 nM	0.560	0.617	0.632
30 nM	0.547	0.615	0.633
30 nM	0.542	0.619	0.624
40 nM	0.532	0.601	0.626
40 nM	0.520	0.619	0.623
40 nM	0.528	0.602	0.629
40 nM	0.517	0.607	0.629
40 nM	0.536	0.607	0.617
50 nM	0.530	0.588	0.594
50 nM	0.512	0.594	0.579
50 nM	0.525	0.595	0.594
50 nM	0.540	0.596	0.595
50 nM	0.543	0.596	0.597

Table S5. Training matrix of the response patterns against the mixtures of these two proteins samples (Hem+BSA) with various molar ratios (total concentration 20 nM) using this sensor array.

proteins	UV-A15	UV-C15	UV-T15
25% Hem+75% BSA	0.770	0.775	0.763
25% Hem+75% BSA	0.774	0.770	0.769
25% Hem+75% BSA	0.770	0.771	0.770
25% Hem+75% BSA	0.771	0.761	0.769
25% Hem+75% BSA	0.766	0.770	0.772
50% Hem+50% BSA	0.790	0.790	0.793
50% Hem+50% BSA	0.789	0.791	0.791
50% Hem+50% BSA	0.790	0.787	0.788
50% Hem+50% BSA	0.789	0.791	0.798
50% Hem+50% BSA	0.790	0.782	0.794
75% Hem+25% BSA	0.807	0.807	0.820
75% Hem+25% BSA	0.810	0.813	0.803
75% Hem+25% BSA	0.803	0.800	0.801
75% Hem+25% BSA	0.803	0.803	0.817
75% Hem+25% BSA	0.810	0.811	0.809
100% Hem	0.841	0.840	0.840
100% Hem	0.849	0.839	0.846
100% Hem	0.840	0.830	0.838
100% Hem	0.847	0.840	0.849
100% Hem	0.833	0.821	0.840
100% BSA	0.914	0.919	0.925
100% BSA	0.918	0.920	0.929
100% BSA	0.921	0.920	0.918
100% BSA	0.918	0.930	0.920
100% BSA	0.928	0.918	0.920

Table S6. Training matrix of the response patterns against proteins (each at 0.2 μM) in the presence of human serum using the sensor array.

proteins	UV-15A	UV-15C	UV-15T
serum	0.579	0.605	0.558
serum	0.559	0.615	0.536
serum	0.599	0.619	0.547
serum	0.586	0.620	0.588
serum	0.572	0.622	0.564
Hem	0.649	0.666	0.702
Hem	0.648	0.698	0.680
Hem	0.654	0.734	0.690
Hem	0.677	0.716	0.701
Hem	0.661	0.709	0.675
Try	1.299	1.301	1.247
Try	1.306	1.293	1.268
Try	1.297	1.283	1.255
Try	1.285	1.301	1.273
Try	1.290	1.302	1.271
BSA	0.565	0.607	0.516
BSA	0.559	0.569	0.536
BSA	0.540	0.587	0.507
BSA	0.520	0.618	0.515
BSA	0.518	0.606	0.530
Pep	1.015	0.918	0.939
Pep	1.015	0.902	0.932
Pep	1.013	0.902	0.947
Pep	1.015	0.904	0.959
Pep	1.012	0.903	0.937
EA	0.889	0.898	0.839
EA	0.808	0.892	0.850
EA	0.877	0.895	0.830
EA	0.870	0.884	0.834
EA	0.845	0.882	0.829
Myo	0.779	0.814	0.822
Myo	0.789	0.812	0.815
Myo	0.786	0.803	0.799
Myo	0.788	0.825	0.797
Myo	0.793	0.825	0.784
Cyt-C	0.553	0.672	0.628
Cyt-C	0.576	0.669	0.623

Cyt-C	0.561	0.684	0.597
Cyt-C	0.584	0.663	0.589
Cyt-C	0.560	0.662	0.588
Con	0.546	0.522	0.669
Con	0.525	0.511	0.644
Con	0.566	0.494	0.656
Con	0.535	0.529	0.657
Con	0.557	0.511	0.655