

Supporting Information

Multicoloured Au NCs based cross-reactive sensor array for multiple proteins discrimination

Shenghao Xu,^a Yufeng Wu^a, Xiaomei Sun^c, Zhuqing Wang^{a,b} and Xiliang Luo^{a*}

^a Key Laboratory of Sensor Analysis of Tumor Marker Ministry of Education, College of Chemistry and Molecular Engineering, Qingdao University of Science and Technology, Qingdao 266042, P. R. China

^b College of Polymer Science and Engineering, Qingdao University of Science and Technology, Qingdao 266042, P. R. China

^c The Affiliated Hospital of Qingdao University, Qingdao 266003, P. R. China

***Corresponding author:**

Prof. Dr. Xiliang Luo, Key Laboratory of Sensor Analysis of Tumor Marker Ministry of Education, College of Chemistry and Molecular Engineering, Qingdao University of Science and Technology, Qingdao 266042, P. R. China, **E-mail:** xiliangluo@qust.edu.cn

Table S1 Basic properties of the target proteins

Proteins	M _w (kDa)	pI
Human serum albumin (HSA)	69.4	5.2
Lysozyme (Lys)	14.4	9.6-11.0
Pepsin (Pep)	35	1.0-2.5
Hemoglobin (Hb)	64.5	6.8
Trypsin (Try)	24.0	10.5
Catalse (CAT)	247.0	8.3
Cytochrome C (Cyt C)	12.3	10.7
Transferrin (Tf)	77	5.6-6.6
Myoglobin (Myo)	17.8	7.6
Bovine serum albumin (BSA)	68	4.6-5.8

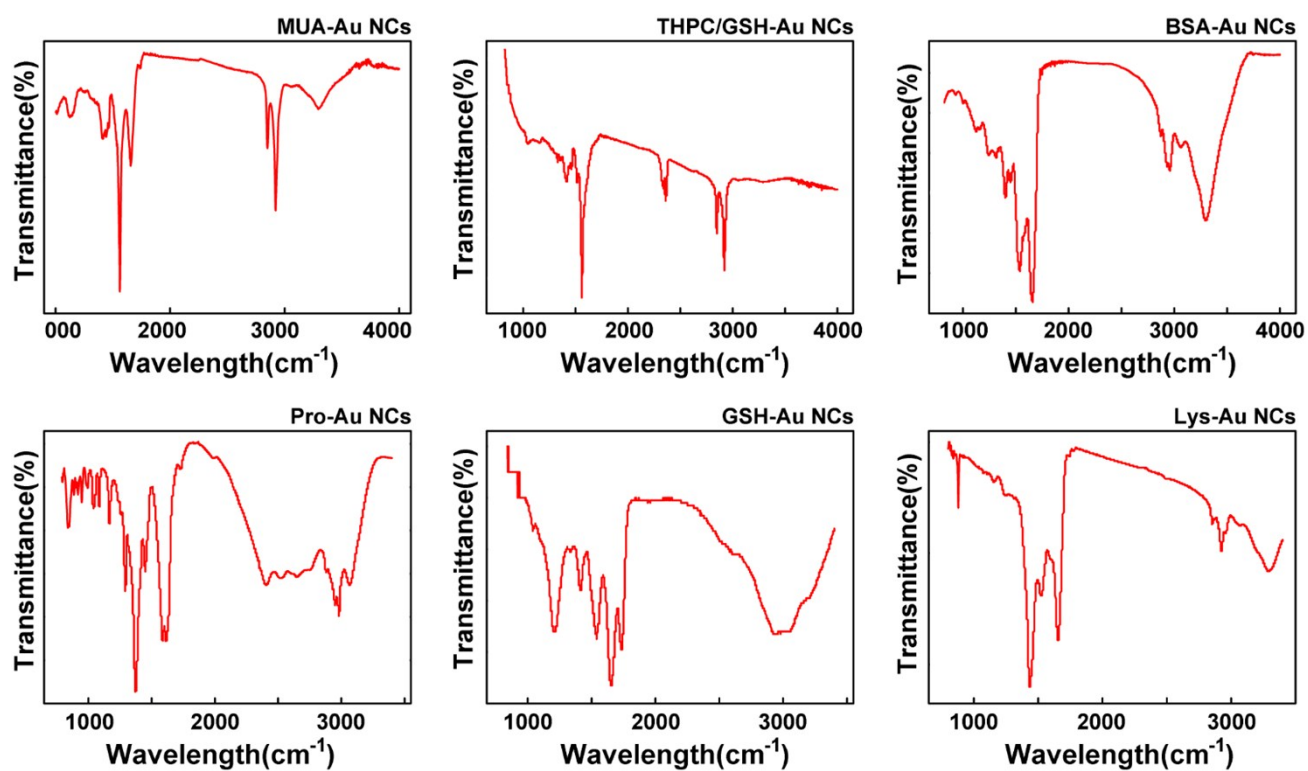


Fig S1 FT-IR spectra of these six kinds of Au NCs.

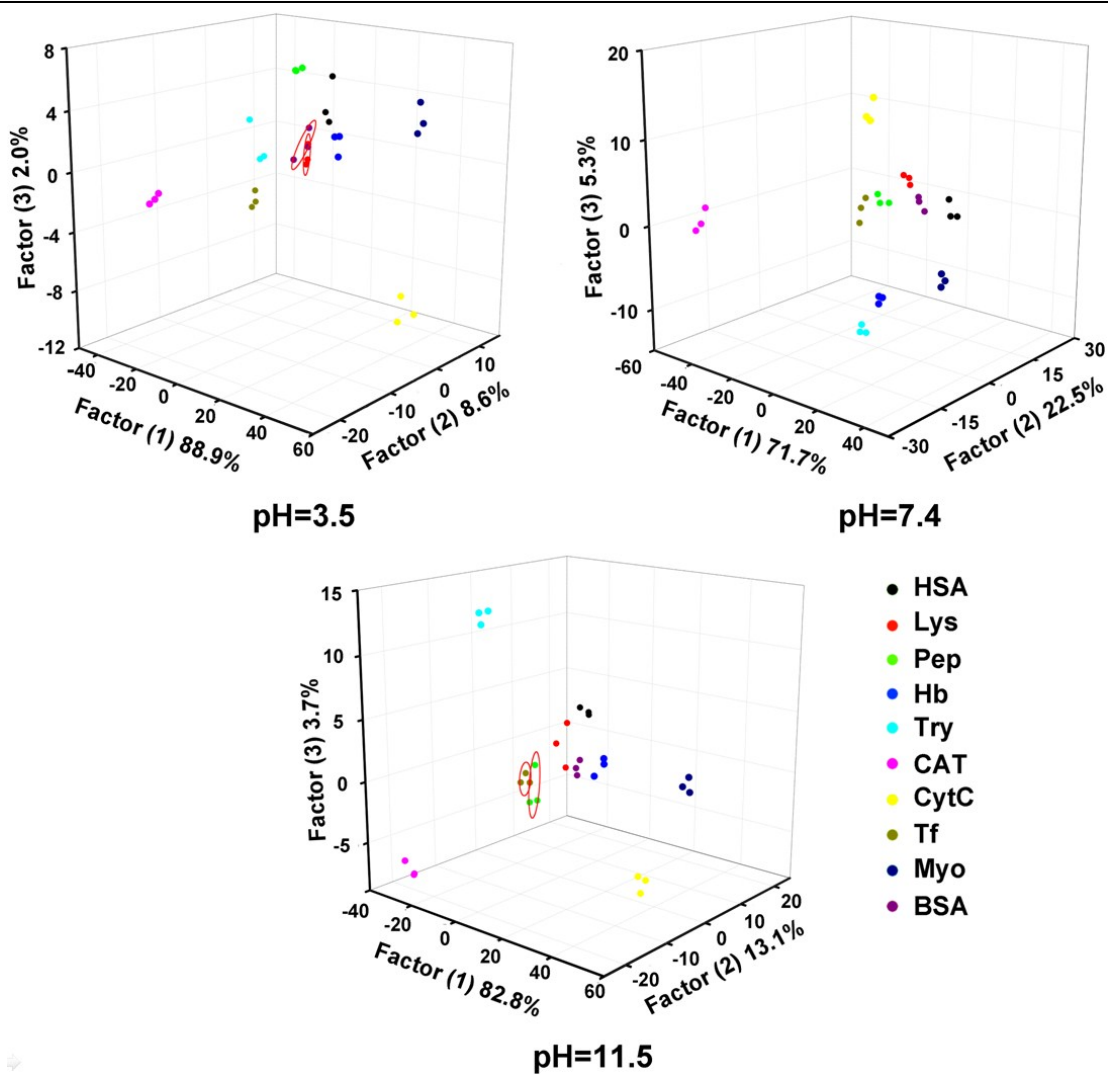


Fig S2 The influence of pH value on the protein discrimination.

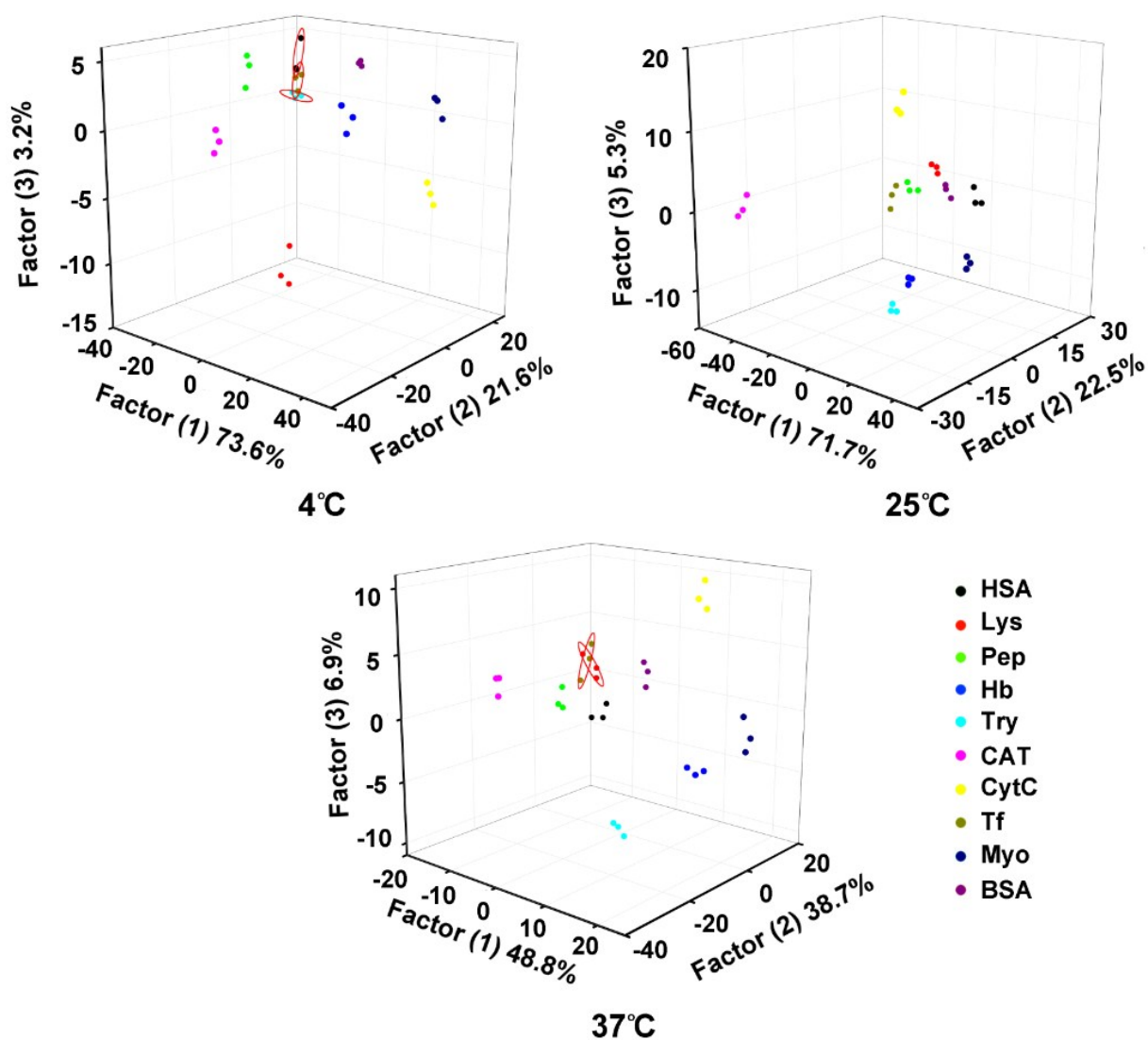


Fig S3 The influence of temperature on the protein discrimination.

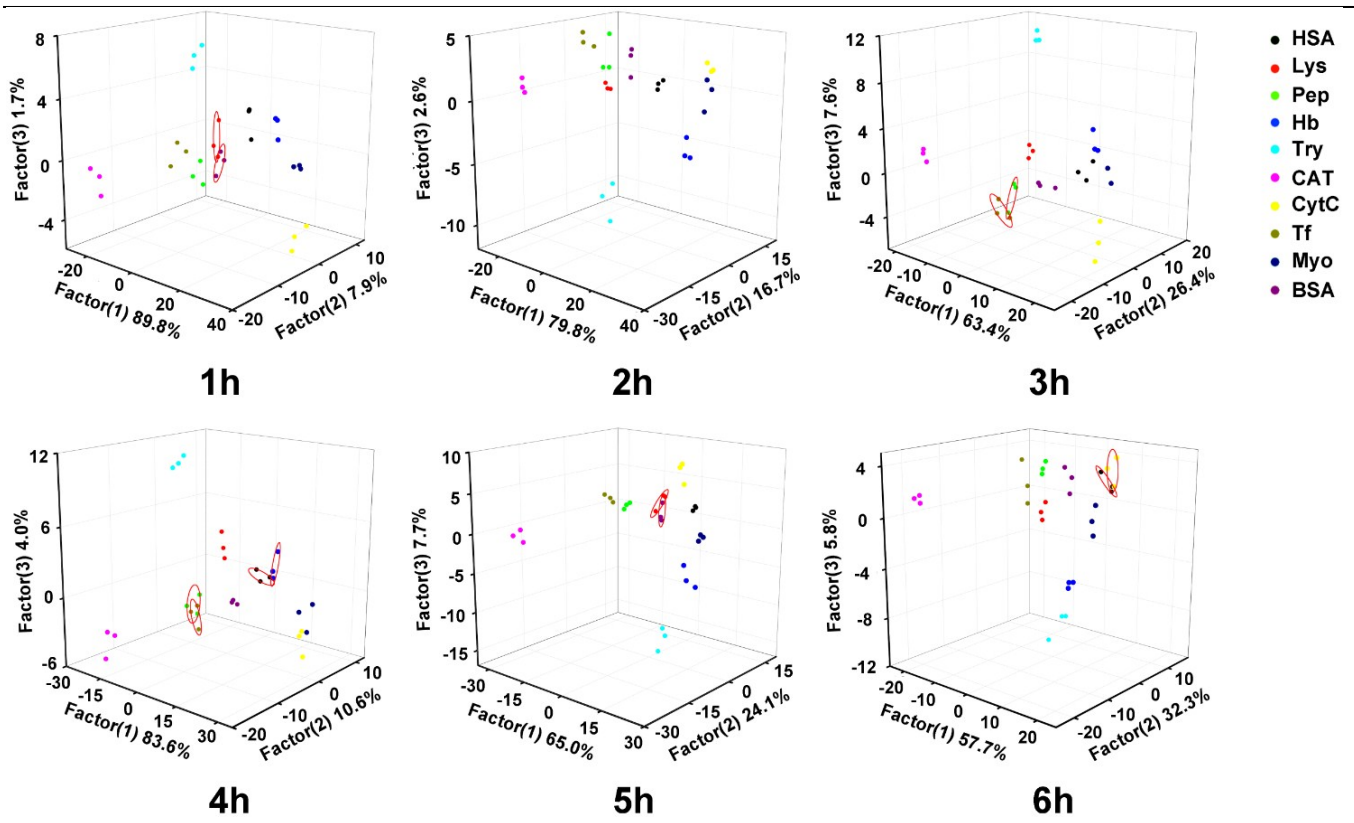


Fig S4 The influence of time on the protein discrimination.

Table S2 Relative fluorescence increase $(I-I_0)/I_0$

	MUA	THPC/GSH	BSA	Pro	GSH	Lys
HSA	0.0100	0.0175	0.0577	-0.0093	0.0370	0.0333
Lys	-0.1542	-0.0088	-0.0128	-0.3194	-0.0296	-0.0556
Pep	-0.0398	-0.0132	-0.0577	-0.0463	-0.0815	-0.0444
Hb	0.2090	-0.0263	0.1667	-0.0185	0.0815	0.0500
Try	-0.0249	-0.0482	0.0897	-0.0741	-0.1704	-0.0389
CAT	-0.0050	-0.1009	-0.1410	-0.1667	-0.2593	-0.1778
CytC	0.2289	0.0132	0.1090	0.0509	0.1259	0.1000
Tf	-0.0796	-0.0395	-0.0962	-0.0694	-0.0889	-0.0667
Myo	0.2289	-0.0132	0.1410	0.0093	0.1481	0.0944
BSA	0.0100	-0.0044	-0.0128	-0.0370	-0.0222	-0.0111

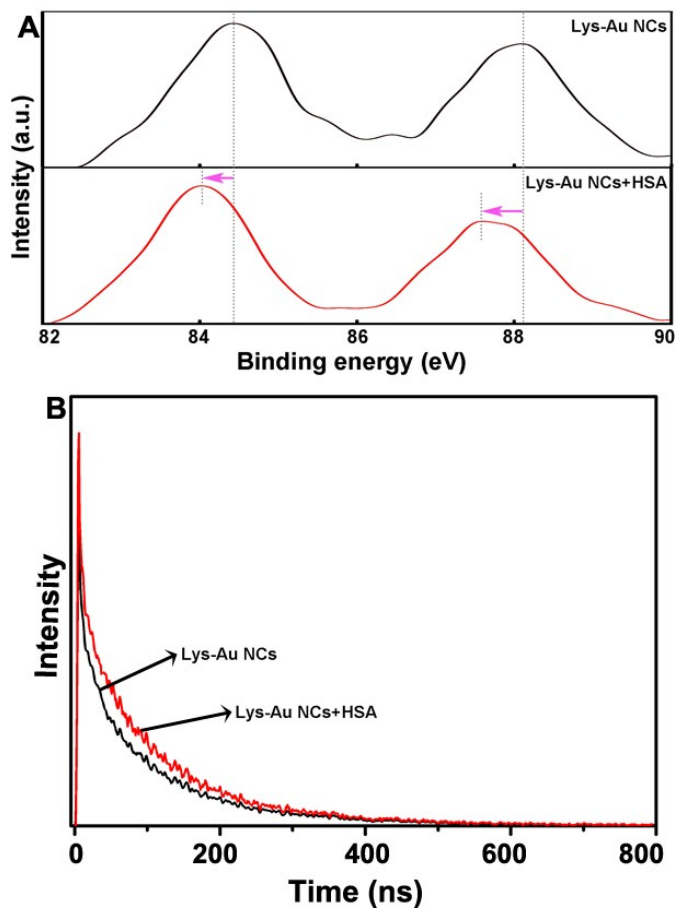


Fig. S5 (A) XPS spectrum of Au_{4f} for Lys-Au NCs and Lys-Au NCs + HSA. (B) Fluorescence lifetime of Lys-Au NCs and Lys-Au NCs + HSA.

Table S3 Identification of 50 unknown protein samples in urine

#	Relative fluorescence increase (I-I ₀)/I ₀						Identi.	Verifi.
	MUA	THPC/GSH	BSA	Pro	GSH	Lys		
1	0.1632	-0.0058	0.1104	0.0420	0.0674	0.0733	HSA	HSA
2	0.2757	-0.0016	0.3413	0.0569	0.0874	0.1148	Lys	Lys
3	0.1767	0.0345	0.1567	0.0549	0.1009	0.0870	Pep	Pep
4	0.0692	0.0360	0.1953	0.1000	0.1604	0.1381	CAT	CAT
5	0.2637	-0.0179	0.3225	0.0542	0.0851	0.0983	Lys	Lys
6	0.1437	-0.0039	0.0819	0.0319	0.0529	0.0757	HSA	HSA
7	0.1663	0.0340	0.1695	0.0573	0.1272	0.0998	Pep	Pep
8	0.2748	-0.0003	0.3550	0.0559	0.0824	0.1037	Lys	Lys
9	0.0449	-0.0146	0.0946	0.0333	0.0408	0.0484	BSA	BSA
10	0.1387	0.0555	0.0275	0.0552	0.1490	0.0851	Try	Try
11	0.1785	0.0193	0.1220	0.0524	0.0548	0.0898	Tf	Tf
12	0.0578	-0.0140	0.0939	0.0307	0.0377	0.0471	BSA	BSA
13	0.1417	0.0598	0.0102	0.0638	0.1323	0.0741	Try	Try
14	0.1395	-0.0056	0.0839	0.0293	0.0694	0.0625	HSA	HSA
15	0.1679	0.0199	0.1219	0.0522	0.0524	0.1021	Tf	Tf
16	-0.0779	-0.0536	-0.1317	0.0061	-0.0211	0.0252	CytC	CytC
17	-0.0726	-0.0609	0.0264	0.0103	-0.0056	0.0217	Myo	Myo
18	-0.0757	-0.0536	-0.1160	0.0200	-0.0206	0.0127	CytC	CytC
19	0.0665	0.0344	0.1997	0.1122	0.1729	0.1364	CAT	CAT
20	0.0458	-0.0169	0.0812	0.0296	0.0446	0.0467	BSA	BSA
21	0.1391	0.0585	0.0080	0.0573	0.1141	0.0774	Try	Try
22	0.0554	-0.0247	0.0800	0.0183	0.0427	0.0474	BSA	BSA
23	-0.0638	-0.0275	0.0386	0.0327	0.0134	0.0389	Hb	Hb
24	0.1628	0.0187	0.1260	0.0658	0.0688	0.0892	Tf	Tf
25	-0.0754	-0.0625	0.0260	0.0201	-0.0021	0.0072	Myo	Myo
26	-0.0740	-0.0541	-0.1207	0.0098	-0.0021	0.0203	CytC	CytC
27	0.1388	0.0550	0.0087	0.0565	0.1341	0.0877	Try	Try
28	0.1636	0.0194	0.1279	0.0550	0.0420	0.0753	Tf	Tf
29	0.0572	0.0313	0.1996	0.1124	0.1593	0.1508	CAT	CAT
30	0.2477	-0.0053	0.3255	0.0559	0.0839	0.1008	Lys	Lys
31	0.1647	0.0353	0.1545	0.0569	0.1322	0.1023	Pep	Pep
32	0.0698	0.0340	0.1802	0.1119	0.1583	0.1392	CAT	CAT
33	0.1531	0.0075	0.0848	0.0438	0.0730	0.0588	HSA	HSA
34	0.1657	0.0194	0.1238	0.0529	0.0401	0.0721	Tf	Tf
35	-0.0735	-0.0607	0.0395	0.0096	-0.0057	0.0220	Myo	Myo
36	0.0703	0.0199	0.1801	0.1024	0.1594	0.1532	CAT	CAT
37	0.1440	0.0591	0.0103	0.0544	0.1314	0.0870	Try	Try
38	-0.0492	-0.0260	0.0218	0.0324	-0.0037	0.0470	Hb	Hb
39	-0.0657	-0.0266	0.0283	0.0293	-0.0064	0.0508	Hb	Hb

40	-0.0499	-0.0282	0.0088	0.0326	0.0129	0.0358	Hb	Hb
41	-0.0869	-0.0483	-0.1347	0.0085	-0.0202	0.0093	CytC	CytC
42	0.1672	0.0312	0.1376	0.0519	0.1185	0.1036	Pep	Pep
43	-0.0752	-0.0529	-0.1191	0.0205	0.0134	0.0122	CytC	CytC
44	-0.0748	-0.0767	0.0250	0.0178	-0.0219	0.0231	Myo	Myo
45	0.1657	0.0351	0.1536	0.0553	0.0982	0.1024	Pep	Pep
46	0.0432	-0.0162	0.0963	0.0325	0.0400	0.0513	BSA	BSA
47	0.2745	-0.0161	0.3076	0.0550	0.0850	0.0996	Lys	Lys
48	-0.0758	-0.0607	0.0391	0.0106	0.0000	0.0201	Myo	Myo
49	-0.0608	-0.0261	0.0399	0.0410	-0.0009	0.0459	Hb	Hb
50	0.1544	-0.0051	0.0953	0.0434	0.0731	0.0593	HSA	HSA

Table S4 Identification of 50 unknown protein samples in human serum

#	Relative fluorescence increase (I-I ₀)/I ₀						Identi.	Verifi.
	MUA	THPC/GSH	BSA	Pro	GSH	Lys		
1	0.1838	0.0384	0.0783	0.0868	0.0621	0.1103	Tf	Tf
2	0.1149	0.0527	-0.0567	0.0776	0.1188	0.0669	Try	Try
3	-0.1926	-0.1065	-0.1392	0.0387	-0.0705	0.0086	Hb	Hb
4	-0.1663	-0.1070	0.0160	0.0356	-0.0163	0.0429	Myo	Myo
5	0.1884	0.0425	0.1001	0.0894	0.0658	0.0984	Tf	Tf
6	0.1841	0.0389	0.0776	0.0778	0.0652	0.1029	Tf	Tf
7	0.1431	-0.0157	0.0633	0.0590	0.0855	0.0547	Pep	Pep
8	0.1387	-0.0914	0.2638	0.0259	-0.0163	0.0423	Lys	Lys
9	0.0266	0.0104	0.0985	0.1932	0.1807	0.1414	CAT	CAT
10	0.0849	-0.0716	-0.0182	0.0090	-0.0472	-0.0065	HSA	HSA
11	0.1262	-0.0213	0.0501	0.0510	0.0669	0.0434	Pep	Pep
12	-0.1809	-0.1025	-0.2264	0.0096	-0.1042	-0.0204	CytC	CytC
13	0.1292	-0.0171	0.0652	0.0605	0.0644	0.0829	BSA	BSA
14	0.0819	-0.0894	-0.0531	-0.0009	-0.0302	-0.0008	HSA	HSA
15	-0.1912	-0.1190	-0.2113	0.0116	-0.1242	-0.0336	CytC	Myo
16	0.1290	-0.0192	0.0645	0.0460	0.0590	0.0695	BSA	BSA
17	0.1990	0.0370	0.1001	0.0857	0.0622	0.1149	Tf	Tf
18	0.1871	0.0409	0.0820	0.0885	0.0641	0.0978	Tf	Tf
19	0.1135	0.0561	-0.0581	0.0769	0.1614	0.0515	Try	Try
20	0.0237	-0.0171	0.0982	0.1812	0.1756	0.1545	CAT	CAT
21	0.1700	-0.0757	0.2970	0.0201	-0.0335	0.0554	Lys	Lys
22	0.0084	-0.0179	0.0811	0.1945	0.1758	0.1427	CAT	CAT
23	0.1414	-0.0179	0.0616	0.0461	0.0854	0.0415	Pep	Pep
24	0.1256	-0.0205	0.0674	0.0586	0.0853	0.0860	BSA	BSA
25	-0.1628	-0.1036	-0.0021	0.0355	-0.0321	0.0280	Myo	Myo
26	0.1724	-0.0902	0.2992	0.0202	-0.0108	0.0403	Lys	Lys
27	0.0950	-0.0785	-0.0205	0.0097	-0.0350	-0.0071	HSA	HSA
28	0.1243	0.0419	-0.0580	0.0779	0.1422	0.0549	Try	Try
29	-0.1895	-0.1029	-0.1258	0.0335	-0.0923	0.0138	Hb	Hb
30	-0.1923	-0.1196	-0.1363	0.0375	-0.0660	0.0102	Hb	Hb
31	0.1404	-0.0320	0.0651	0.0765	0.0679	0.0405	Pep	Try
32	-0.1917	-0.1190	-0.1552	0.0389	-0.0882	0.0138	Hb	Hb
33	0.1240	-0.0200	0.0497	0.0646	0.0598	0.0721	Pep	Pep
34	-0.1771	-0.1193	0.0139	0.0232	-0.0134	0.0435	Myo	Myo
35	-0.1909	-0.1197	-0.2220	0.0077	-0.1457	-0.0185	CytC	CytC
36	0.0275	-0.0032	0.0796	0.1945	0.1737	0.1610	CAT	CAT
37	-0.1928	-0.1043	-0.2280	0.0088	-0.1092	-0.0349	CytC	CytC
38	-0.1903	-0.1204	-0.1379	0.0359	-0.0661	0.0130	Hb	Hb

39	0.0812	-0.0926	-0.0405	-0.0013	-0.0528	-0.0007	HSA	HSA
40	0.1559	-0.0899	0.2649	0.0196	-0.0129	0.0399	Lys	Lys
41	-0.1660	-0.1001	-0.0025	0.0199	-0.0271	0.0372	Myo	Myo
42	-0.1935	-0.1198	-0.2269	0.0125	-0.1278	-0.0177	CytC	CytC
43	0.1297	-0.0179	0.0780	0.0624	0.0819	0.0876	BSA	BSA
44	0.1276	0.0370	-0.0734	0.0771	0.1563	0.0678	Try	Try
45	0.1264	0.0404	-0.0559	0.0746	0.1431	0.0668	Try	Try
46	0.0950	-0.0760	-0.0421	0.0105	-0.0660	-0.0009	HSA	HSA
47	-0.1629	-0.1187	-0.0023	0.0203	-0.0266	0.0264	Myo	Myo
48	0.1872	-0.0901	0.3024	0.0215	-0.0109	0.0396	Lys	Lys
49	0.1264	-0.0160	0.0784	0.0455	0.0873	0.0703	BSA	BSA
50	0.0246	-0.0064	0.0984	0.1766	0.1763	0.1583	CAT	CAT

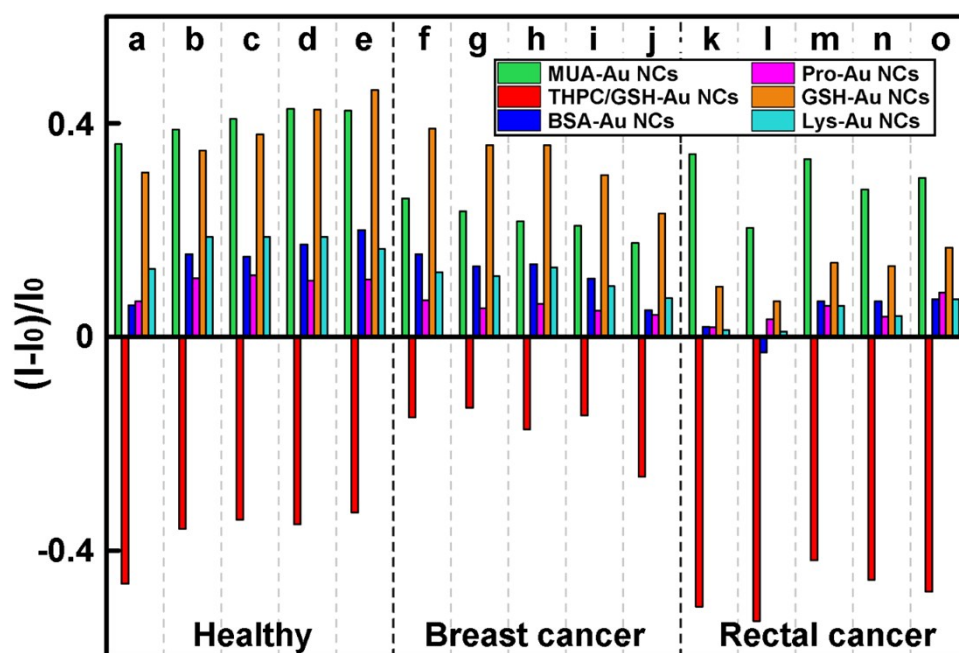


Fig. S6 Fluorescence response histogram of the six kinds of Au NCs against healthy people, breast cancer patients and rectal cancer patients.

Table S5 Relative fluorescence increase $(I-I_0)/I_0$						
	MUA	THPC/GSH	BSA	Pro	GSH	Lys
Healthy	0.361	-0.462	0.059	0.067	0.308	0.127
	0.388	-0.360	0.155	0.110	0.349	0.187
	0.408	-0.342	0.150	0.115	0.379	0.187
	0.427	-0.351	0.173	0.105	0.426	0.187
	0.424	-0.329	0.200	0.108	0.462	0.165
Breast cancer	0.259	-0.151	0.155	0.069	0.390	0.121
	0.235	-0.133	0.132	0.054	0.359	0.114
	0.216	-0.173	0.136	0.062	0.359	0.130
	0.208	-0.147	0.109	0.049	0.303	0.095
	0.176	-0.262	0.050	0.041	0.231	0.073
Rectal cancer	0.342	-0.505	0.019	0.018	0.094	0.013
	0.204	-0.532	-0.029	0.033	0.067	0.010
	0.333	-0.418	0.067	0.058	0.139	0.058
	0.276	-0.455	0.067	0.038	0.133	0.039
	0.298	-0.477	0.071	0.083	0.167	0.071