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Supporting Information for

Rapid Coating of Surfaces with Functionalized Nanoparticles for Regulation of Cell Behavior

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Experimental

Syntheses of Ligands and AuNPs. The syntheses of most ligands have been reported elsewhere[1] except T-Phe and T-Adman ligands.

Synthesis of T-Phe ligand. The synthesis of T-Phe ligand was similar to that of T-Arg ligand.[1c] Briefly, trityl protected amine (Trt-C11-TEG-NH_2) was firstly coupled with Boc-Phe-OH through EDC coupling. Then the resulting protected T-Phe was cleaved by trifluoroacetic acid (TFA) in the presence of triisopropylsilane (TIPS). T-Phe ligand was purified by washing the crude product with hexane and diethylether for three times, respectively. ^{1}H NMR (400MHz, $CDCl_3$, δ): 7.35-7.31 (5H, m, Ar), 5.32 (1H, s, -NH-), 4.12-4.08 (1H, m, -CH-), 3.76-3.28 (19H, -OCH_2-, CH_2Ar), 3.08-3.02 (1H, s, -CH_2Ar), 2.53 (2H, q, J = 7.5 Hz, -SCH_2-), 1.65-1.54 (4H, m, -CH_2-), 1.41-1.27 (14H, m, -CH_2-). MS (ESI, m/z): M^+ calcd for C28H50N2O5S, 526.3; found, 526.5.

Synthesis of T-Adman ligand. The synthesis of T-Adman ligand also followed the previous published method.[1a] Briefly, trityl protected methanesulphonate (Trt-C11-TEG-MS) was reacted with dimethyladamantaneamine in mixed solution of dichloromethane (DCM) and ethanol (1:3, v/v) at 40 °C for 72 h. The product was then washed by hexane and hexane/DCM mixture (10:1, v/v) for five times, respectively. After that, T-Adman ligand was obtained by cleaving the washed product using TFA and TIPS followed by hexanes washing for three times. ^{1}H NMR (400MHz, $CDCl_3$, δ): 3.97 (br, 2H, -OCH_2-(CH_2N)-), 3.74-3.58 (m, 14H, -CH_2O- + -CH_2N-), 3.46 (t, 2H, -CH_2O-), 3.07 (s, 6H, -$(CH_3)_2$N-), 2.78 (s, 3H, CH_3SO^{-3}-), 2.58 (q, 2H, -CH_2S-), 2.36-2.12 (br, 9H, HAdamantane), 1.92-1.70 (br, 6H, HAdamantane), 1.51-1.12 (m, 18H, -(SCH_2)CH_2 + -CH_2(CH_2O)- + SH + -CH2-). MS (ESI, m/z): M^+ calcd for C31H60NO4S, 542.4; found, 542.5.

Syntheses of functionalized AuNPs. The syntheses of functionalized AuNPs were accomplished by place exchange in the presence of purified ligands as described before.[2]

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[1] a) O. R. Miranda, H. T. Chen, C. C. You, D. E. Mortenson, X. C. Yang, U. H. F. Bunz, V. M. Rotello, *J. Am. Chem. Soc.* **2010**, 132, 5285; b) C. C. You, O. R. Miranda, B. Gider, P. S. Ghosh, I. B. Kim, B. Erdogan, S. A. Krovi, U. H. F. Bunz, V. M. Rotello, *Nat. Nanotechnol.* **2007**, 2, 318; c) P. Ghosh, X. C. Yang, R. Arvizo, Z. J. Zhu, S. S. Agasti, Z. Mo, V. M. Rotello, *J. Am. Chem. Soc.* **2010**, 132, 2642; d) X. C. Yang, B. Samanta, S. S. Agasti, Y. Jeong, Z. J. Zhu, S. Rana, O. R. Miranda, V. M. Rotello, *Angew. Chem. Int. Edit.* **2011**, 50, 477; e) S. G. Elci, D. F. Moyano, S. Rana, G. Y. Tonga, R. L. Phillips, U. H. F. Bunz, V. M. Rotello, *Chem. Sci.* **2013**, 4, 2076.

[2] D. Moyano, V. Rotello, in *Cellular and Subcellular Nanotechnology*, Vol. 991 (Eds: V. Weissig, T. Elbayoumi, M. Olsen), Humana Press, **2013**, pp. 1.

Table S1 Cell viability assay for 26 different AuNP coatings (values of Figure 3a)

AuNP			HepG2		MCF7		HeLa		3T3	
name	conc. (ng/well)	sd	avg (%)	sd	avg (%)	sd	avg (%)	sd	avg (%)	sd
TTMA	309.9	178.1	189.9	2.6	157.7	2.3	126.9	7	122.7	3.5
T-C2	194.1	17.8	200.5	4	160.6	8.1	117.6	3.2	114.5	6.1
T-C4	294.7	30.0	197.1	9.6	146.7	8.4	109.4	6.4	107	7.4
T-C6	182.7	28.9	180.1	6.8	145.2	5	104.6	3	112	17.6
T-C10	85.1	9.1	148.1	9.7	146.1	45.1	88.3	7.3	96.7	8.5
T-C14	109.8	6.6	143.1	7.1	133.8	8.7	97.4	5.9	104.1	9
T-cyC6	260.6	20.1	170.2	1.1	115.2	5.4	120.8	4	122.5	1.9
T-dbC6	123.9	11.5	83.2	9.5	65.8	4.8	83.5	17.1	56.4	6.8
T-cyC12	146.6	18.4	100.3	6.7	84.5	15.5	91.9	5.7	81.8	5.1
T-Adman	573.7	23.8	146.9	7.5	140.5	6.5	130.6	7.1	112.5	8.3
T-Ph	191.1	14.8	145.9	5	86.8	3.9	99.2	2.3	89.3	5
T-Benzyl	228.1	1.3	206.3	3.7	105.2	9.8	114.4	5.1	119.5	4.2
T-cyC6-Ph	151.1	5.2	96	3.6	78.3	5.4	93.7	2.7	83.2	4.4
T-C2-NH2	270.4	6.0	136.1	9.6	138.9	8.1	123.5	5.5	112.8	6.9
T-C3-NH2	244.6	6.9	162	16.9	140.8	11.3	113.5	4.1	110.7	7.3
T-C6-NH2	518.2	30.0	151.4	4	137.3	13.1	113.1	6	109.8	2.9
T-C3-OH	498.7	16.6	137.1	7.3	125.9	16.5	102.2	4.8	104.6	5.7
T-C3-OH2	473.1	25.4	168.8	7.9	134.3	6.1	110.4	5.4	102.8	9.3
T-Glu	481.2	19.9	142.9	8.5	128.9	4.7	98.5	9.4	99.2	9.7
T-Man	259.6	16.1	167.3	8	138.8	10.3	102.6	4.3	101.9	9.3
T-Gal	352.6	18.2	165.5	10.1	137	2.9	104.2	1.6	103.8	7
T-Arg	226.0	40.3	123.4	4.3	127.9	1.6	101.7	1.3	106	3.3
T-Lys	155.9	11.2	120.4	5.7	124.8	2.5	107	1	105.5	1.1
T-Phe(L)	310.9	60.9	107.3	6.1	118.6	6.4	132.8	7.9	107.3	5.3
T-Phe(D)	267.1	4.3	105.1	9.6	114.9	8	121.3	9	105.4	8.4
T-HKRK	245.8	6.8	134.3	2.6	123.4	8	131.6	5	119.5	2.9
water	-	-	93	2.4	98.1	5.5	110.3	6.6	102.3	5.8
blank	-	-	100	4.3	100	0.8	100	2.9	100	4.4

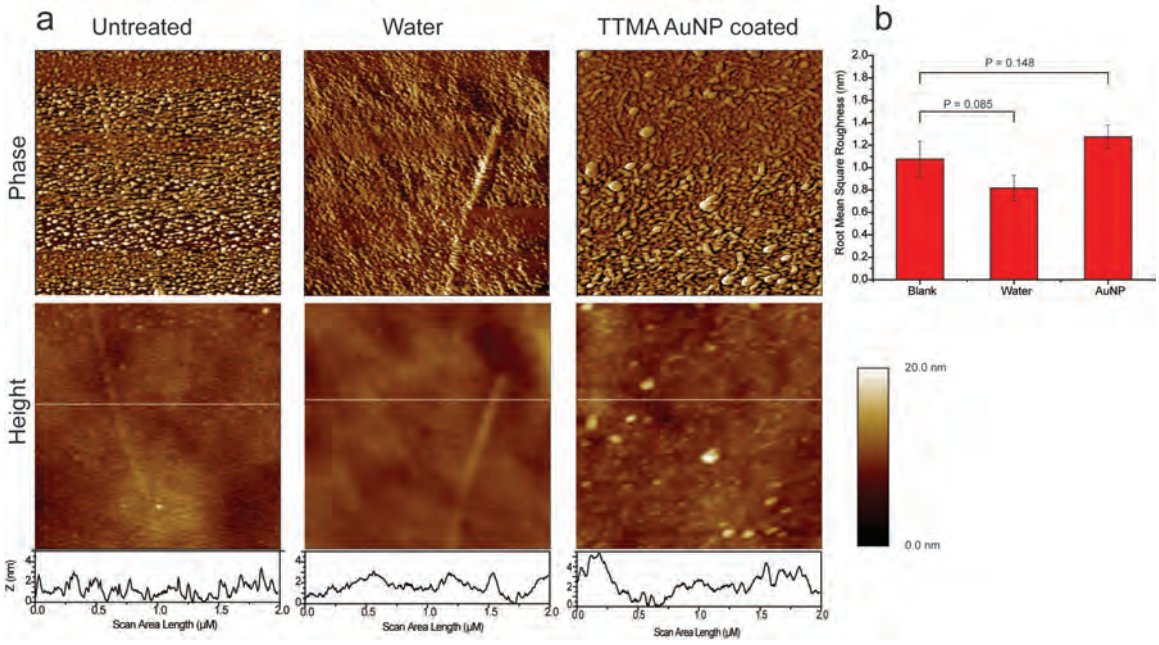

Figure S1. Characterizations of cell culture plate surface after TTMA AuNP coating. Untreated surface and surface treated with water without AuNPs were used as controls. a) AFM images and related roughness measurements. b) Mean roughness values with triplicate determinations.

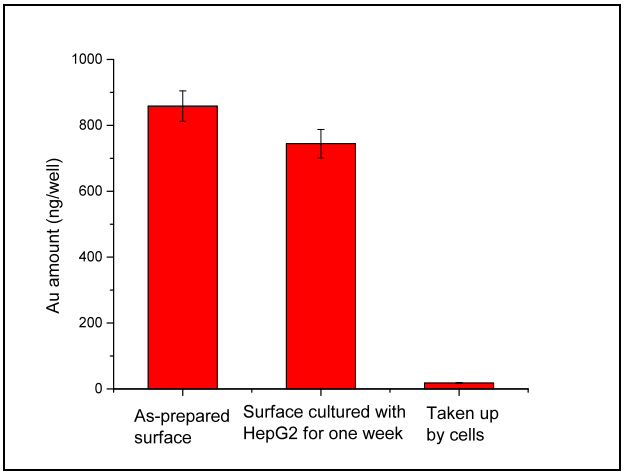

Figure S2. AuNPs amount taken up by cells and left on the cell culture plate surface after one week culture of HepG2 cells (started at 30,000 cells/well). The cell culture media were replaced every other day.

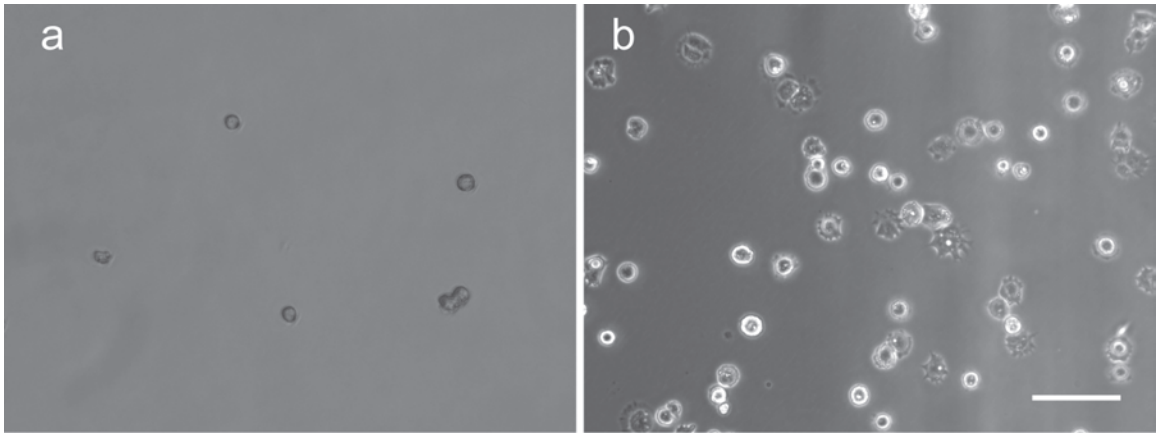

Figure S3. Attachment of HepG2 cells after 80 min incubation on cell culture plates a) without or b) with TTMA AuNP coating. Bar: 100 μm

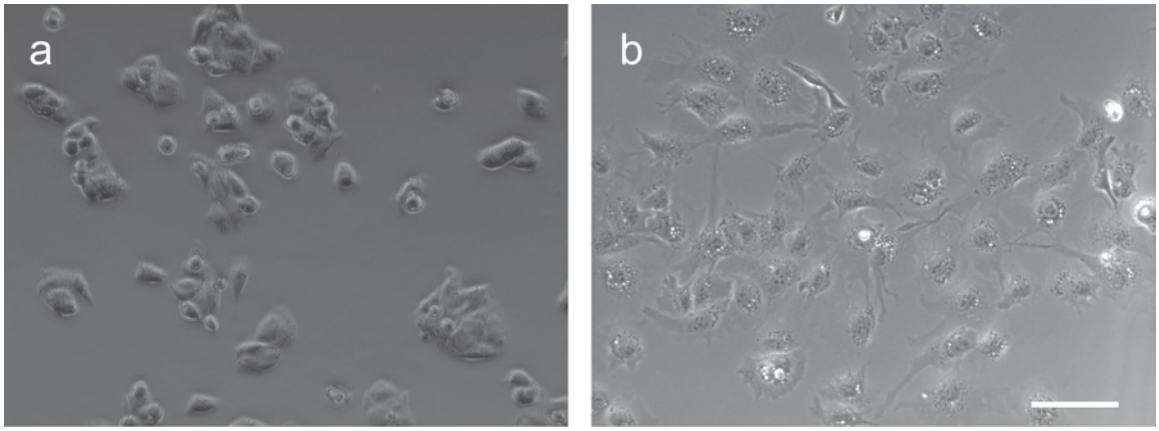

Figure S4. Optical images of HepG2 cell grown on a) plasma-treated plate and b) TTMA AuNP coated surface. Bar: 100 μm

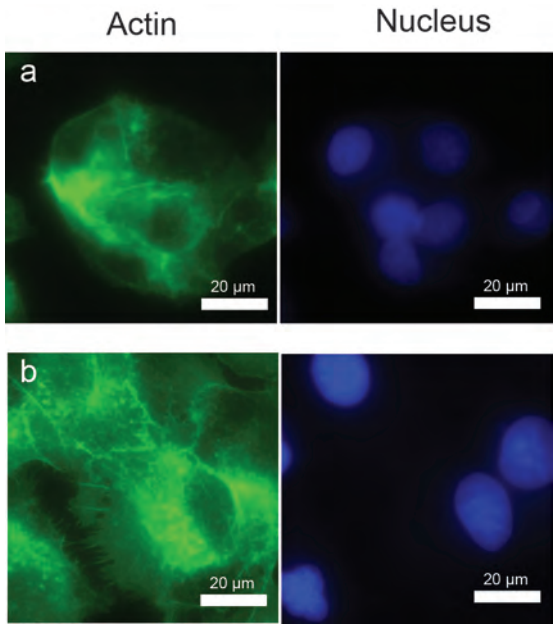

Figure S5. Fluorescent images of HepG2 cell cultured for 24 h on plates with and without the TTMA AuNP layer (separated fluorescent channels of a) Figure 2c and b) Figure 2d). F-actin was stained by Oregon Green labeled phallotoxin, and the nuclei were stained by Hoechst 33342.

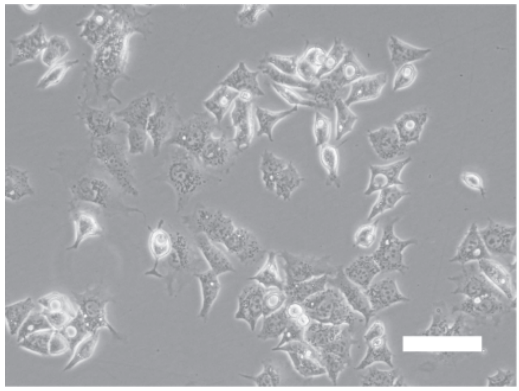

Figure S6. HepG2 cells growing on TTMA CdSe quantum dots coated surface for 24 h showed similar morphology as those growing on TTMA AuNP coated surface. Bar: 100 μm

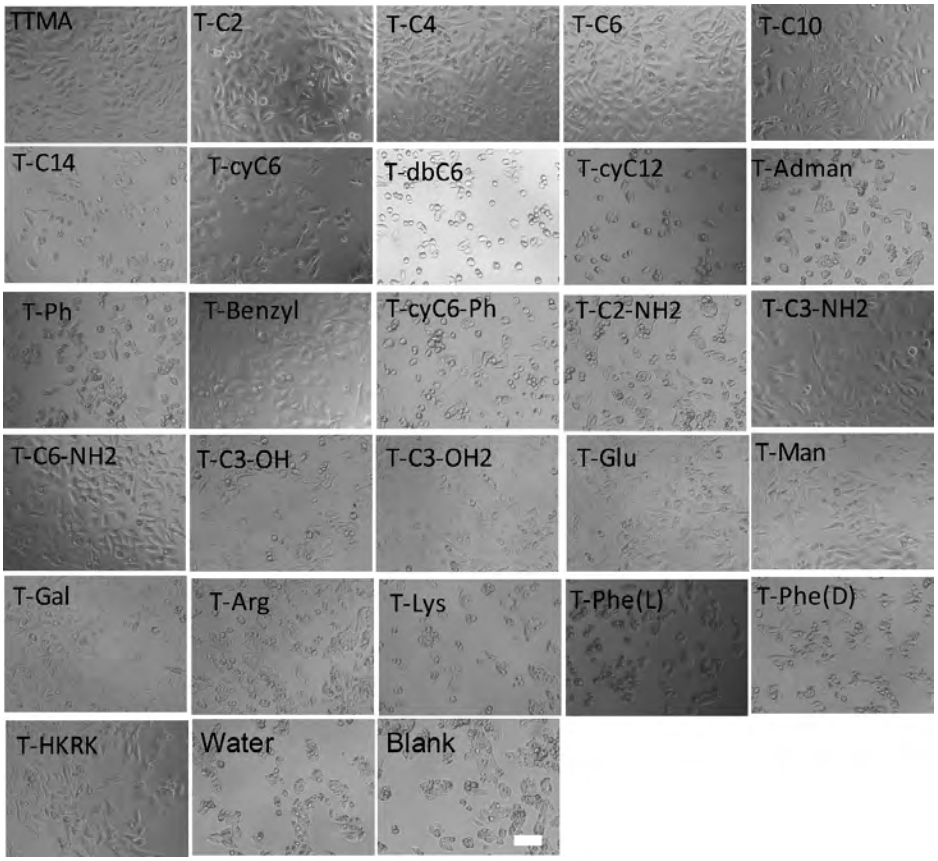

Figure S7. Morphologies of HepG2 cell in the presence of AuNPs listed in Figure 3. Bar: 100 μm

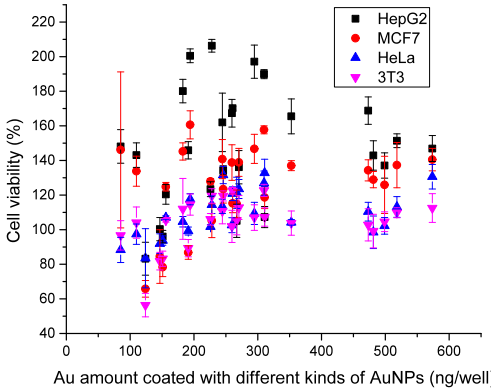

Figure S8. Cell viability variations induced by different kinds of AuNP coatings (data from Table S1). R^2 values of linear fitting are -0.012, 0.175, 0.012 and 0.067 for HepG2, MCF7, HeLa and 3T3 groups, respectively.