Supporting information

Tumor chemo-radiotherapy with rod-shaped and spherical gold nano probes: shape and active targeting both matter

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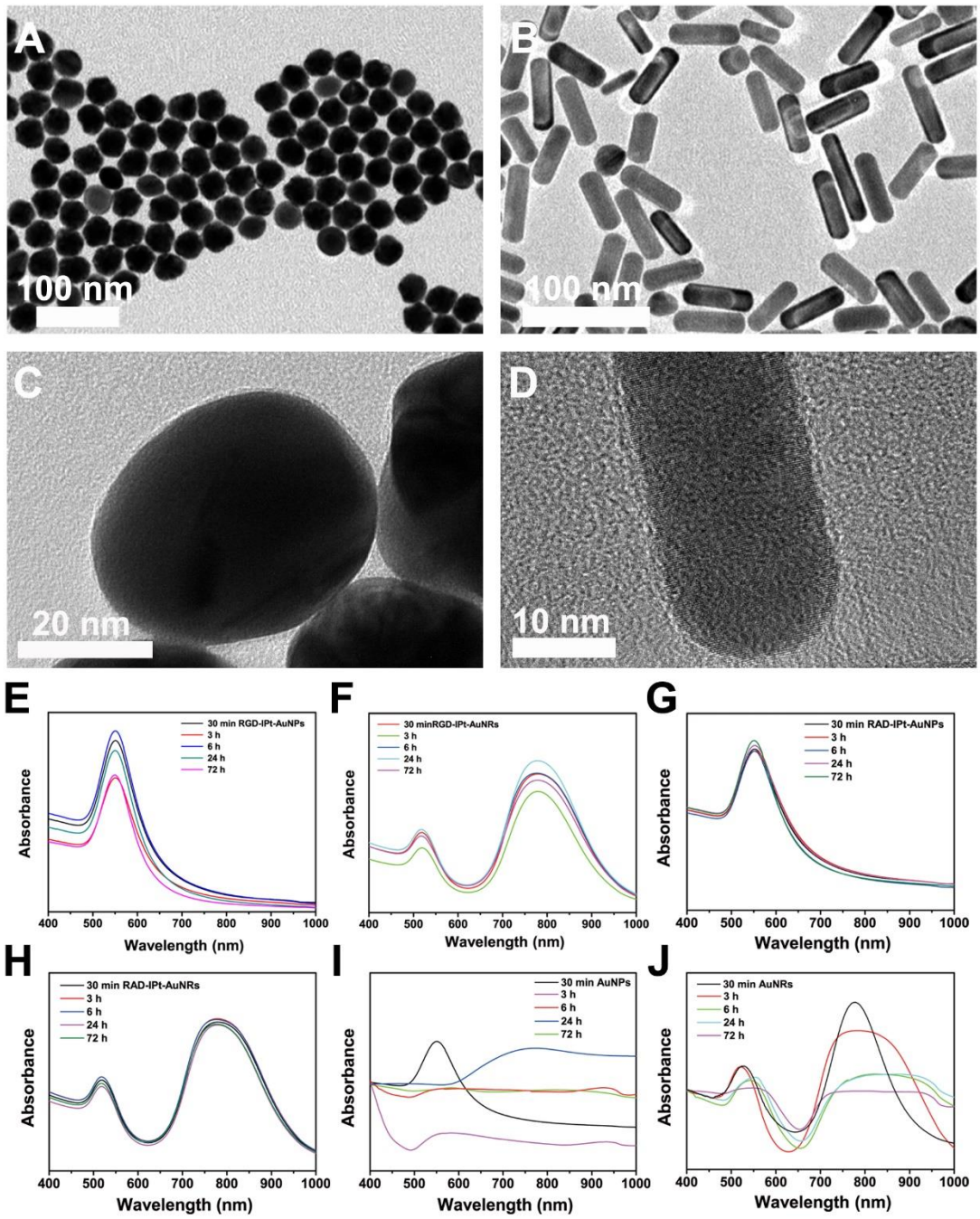

Figure S1. A, B: TEM images of AuNPs (A) and AuNRs (B). C, D: High resolution TEM images of RGD-IPt-AuNPs (C) and RGD-IPt-AuNRs (D). E-J: UV-vis spectra of RGD-IPt-AuNPs (E), RGD-IPt-AuNRs (F), RAD-IPt-AuNPs (G), RAD-IPt-AuNRs (H) and pristine AuNPs (I) and AuNRs (J) in RPMI-1640 with 10% FBS.

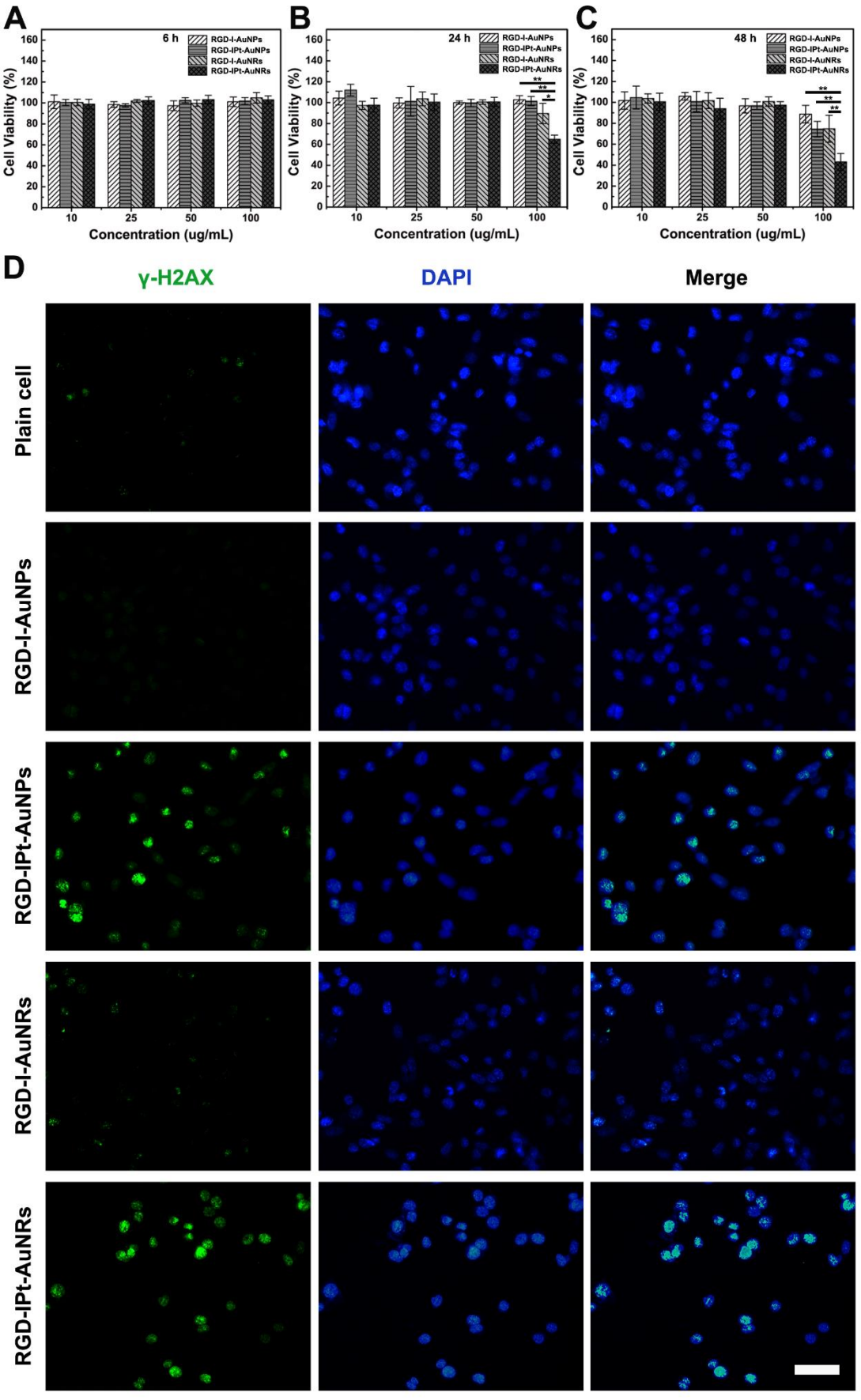

Figure S2. Chemotherapy of H1299 cells. A-C: Viability of the cells treated with the

probes at different concentrations for 6 h (A), 24 h(B) and 48 h(C). *, $p < 0.05$; **, $p < 0.01$. D: γ-H2AX immunostaining of H1299 cells treated with the probes at the concentration of 50 μg Au/ mL for 48 h. Scale bar: 20 μm.

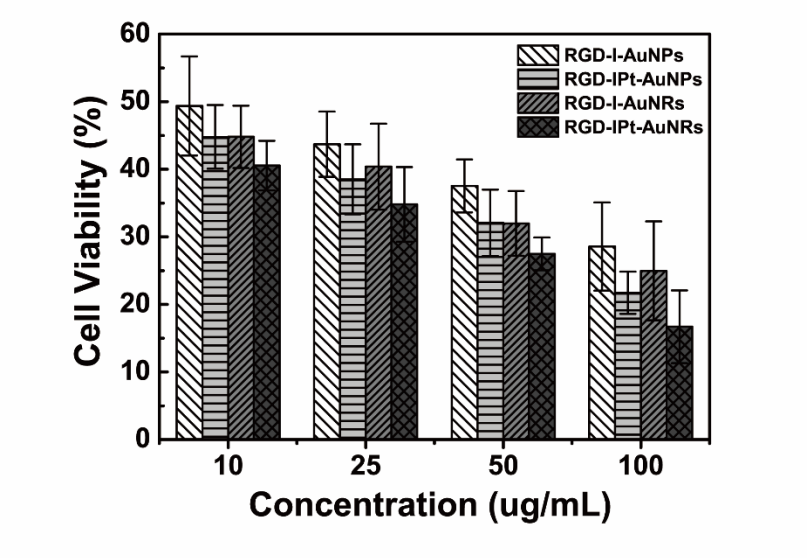

Figure S3. Chemo-radiotherapy of tumor cells treated with the probes at different concentrations

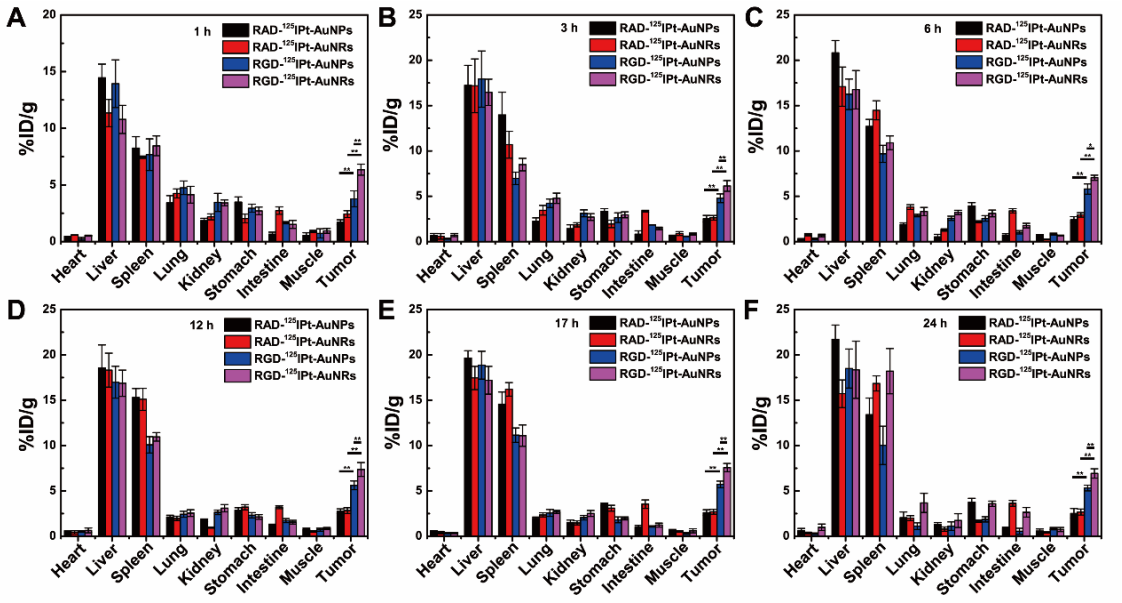

Figure S4. Bio-distributions of RAD or RGD probes at 1 h (A), 3 h (B), 6 h (C), 12 h(D), 17 h (E), 24 h (F) after intravenous injection. *, $p < 0.05$; **, $p < 0.01$.

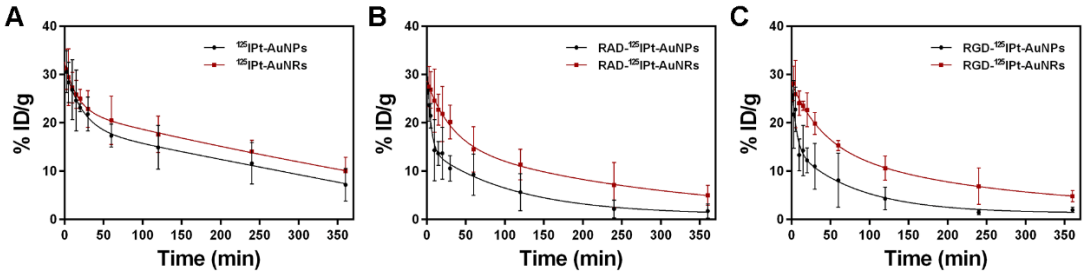

Figure S5. Blood elimination half-life of PEG modified Au NPs (A), RAD probes (B) and RGD probes (C).

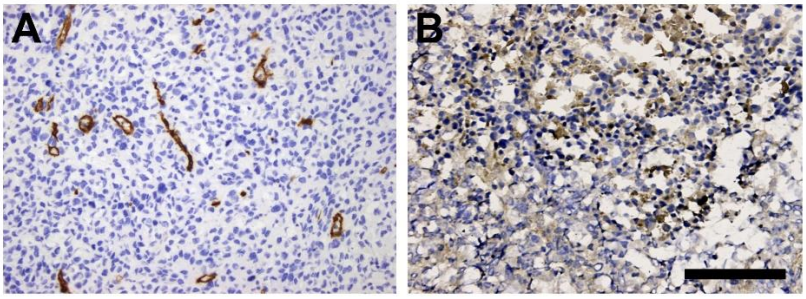

Figure S6. Histochemical studies of tumor tissues. A, B: Immunostaining of tumor tissues against CD31 (A) and $\alpha v\beta 3$ integrin against CD61 (B). Scale bar = 100 μm.

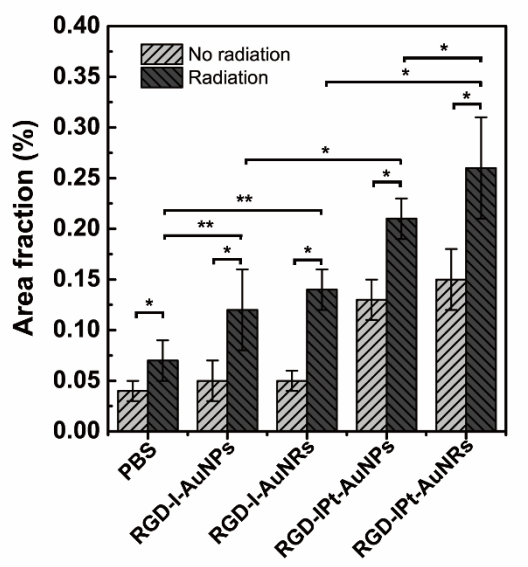

Figure S7. Quantifications of DNA damages in tumor tissues after treatments. Tumor tissues were stained against γ-H2AX. *, $p < 0.05$; **, $p < 0.01$.

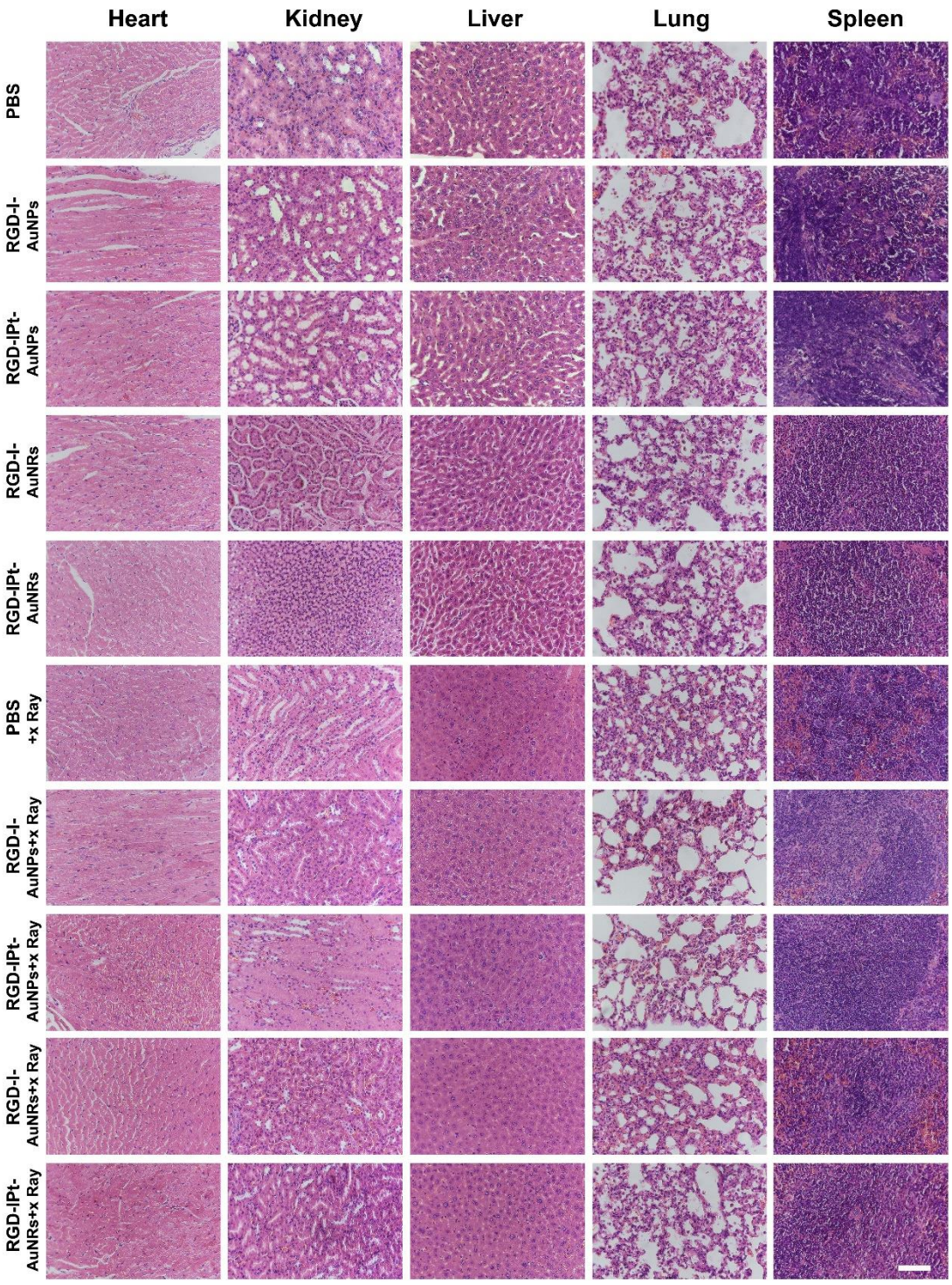

Figure S8. Hematoxylin/eosin staining of major organs from mice in different groups 21 days post treatments. Scale bar = 100 μm.

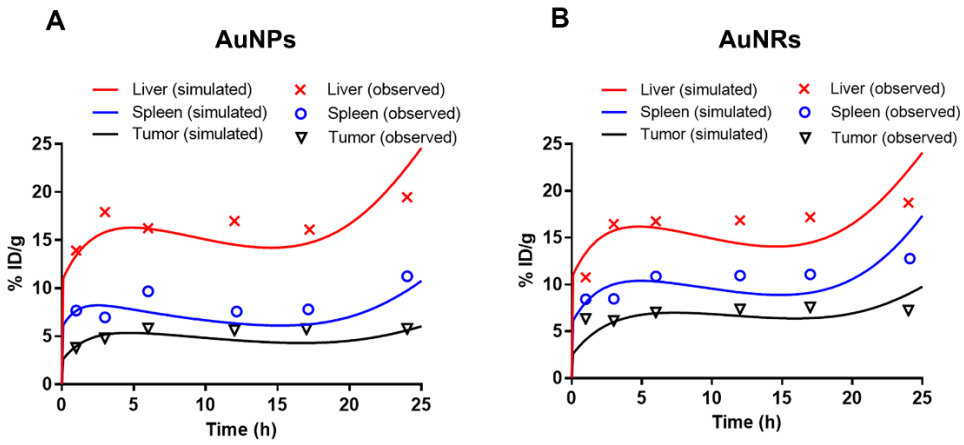

Figure S9. Model calibration results of RGD-^{125}IPt-AuNPs and RGD-^{125}IPt-AuNRs probes in main organs of mice with experimental data. The line represents the concentration-time profile of the NPs simulated by the model.

Table S1. Zeta potentials of the AuNPs and AuNRs at each step of probe preparation.

Probes	**Zeta potential (mV)**	**Probes**	**Zeta potential (mV)**
AuNPs	-8.49 ± 2.58	AuNRs	31.01 ± 4.07
PDA@ AuNPs	24.93 ± 5.23	PDA@AuNRs	22.31 ± 2.68
PEG-PDA@AuNPs	-10.23 ± 3.33	PEG-PDA@AuNRs	-13.67 ± 2.46
RGD- IPt-AuNPs	-26.92 ± 6.17	RGD-IPt-AuNRs	-28.44 ± 4.36
RAD- IPt-AuNPs	-20.74 ± 3.57	RAD- IPt-AuNRs	-24.72 ± 3.39

Table S2. Parameters of AuNPs and AuNRs probes.

	RGD-IPt-AuNPs	**RGD-IPt-AuNRs**
Size（nm）	56.37 ± 3.04	（56.12 ± 3.22）×（22.41 ± 1.01）
Surface area（nm^2）:	9977.59	3945.85
Volume of each particle (nm^3)：	93739.47	19155.78
Mass of each particle（ag）:	1.81	0.37
Number of particles（1mg）	2.86×10^{12}	13.99×10^{12}
Amount of PEG molecules immobilized on a particle：	128.09 ± 14.01	103.51 ± 20.95
Amount of RGD peptide conjugated on a particle：	67.33 ± 9.04	61.62 ± 2.15
Gold content in a cell：（pg/cell）	48.86 ± 4.32	56.46 ± 6.44

Table S3. Blood half-lives of different types of nanoprobes.

Probes	**Blood half-lives (min)**
^{125}IPt-AuNPs	124.60 ± 12.71
^{125}IPt-AuNRs	258.22 ± 11.03
RAD- ^{125}IPt-AuNPs	94.73 ± 3.39
RAD- ^{125}IPt-AuNRs	213.39 ± 22.23
RGD- ^{125}IPt-AuNPs	79.99 ± 4.39
RGD- ^{125}IPt-AuNRs	227.36 ± 28.91

Table S4. Parameters of two compartment modelling of blood half-lives.

Parameter	Unit	Value (RGD- IPt-AuNPs)	Value (RGD- IPt-AuNRs)
k10	1/min	0.01744487	0.005375791
k12	1/min	0.070672609	0.008069912
k21	1/min	0.078413326	0.013571193
$t_{1/2}$ α	min	4.390737262	28.9127711
$t_{1/2}$ β	min	79.99371624	227.7722557
C_0	%/ml	29.23989983	28.32567533
V	(%)/(%/ml)	3.419984356	3.530365961
CL	(%)/(%/ml)/min	0.059661181	0.018978508
V2	(%)/(%/ml)	3.082374277	2.099280693
CL2	(%)/(%/ml)/min	0.241699218	0.028489744
AUC 0-t	%/ml*min	1606.432604	3703.574985
AUC 0-inf	%/ml*min	1676.13176	5269.118038
AUMC	%/ml*min^2	182678.4128	1562992.854
MRT	min	108.9880982	296.6327273
Vss	%/(%/ml)	6.502358633	5.629646654

Table S5. Parameters derived from PBPK modelling.

Parameters	RGD-^{125}IPt-AuNPs	RGD-^{125}IPt-AuNRs	RAD-^{125}IPt-AuNPs	RAD-^{125}IPt-AuNRs	Organs
Distribution coefficients (P)	0.15	0.15	0.15	0.15	Lung
	0.50	0.50	0.50	0.50	Liver
	0.15	0.30	0.15	0.30	Spleen
	0.01	0.01	0.01	0.01	Kidneys
	0.15	0.25	0.15	0.25	Tumor
	0.15	0.15	0.15	0.15	Rest of body
Distribution limitation coefficients constants (PA)	0.001	0.001	0.001	0.001	Lung
	0.001	0.001	0.001	0.001	Liver
	0.001	0.001	0.001	0.001	Spleen
	0.0001	0.0001	0.0001	0.0001	Kidneys
	0.001	0.001	0.001	0.001	Tumor
	0.00001	0.00001	0.00001	0.00001	Rest of body
Maximum uptake rate constant (Kup_{max})	0.075	0.075	0.075	0.075	Lung
	30	30	30	30	Liver
	30	60	30	60	Spleen
	0.005	0.005	0.005	0.005	Kidneys
	10	20	10	20	Tumor
	0.2	0.2	0.2	0.2	Rest of body
Out organ rate constant (Kout)	0.003	0.003	0.003	0.003	Lung
	0.001	0.001	0.001	0.001	Liver
	0.001	0.001	0.001	0.001	Spleen
	0.0004	0.0004	0.0004	0.0004	Kidneys
	0.001	0.001	0.001	0.001	Tumor
	0.0001	0.0001	0.0001	0.0001	Rest of body