

Supplemental Section for

Short-chain PEG Mixed-Monolayer Protected Gold Clusters Increase Clearance and Red Blood Cell Counts

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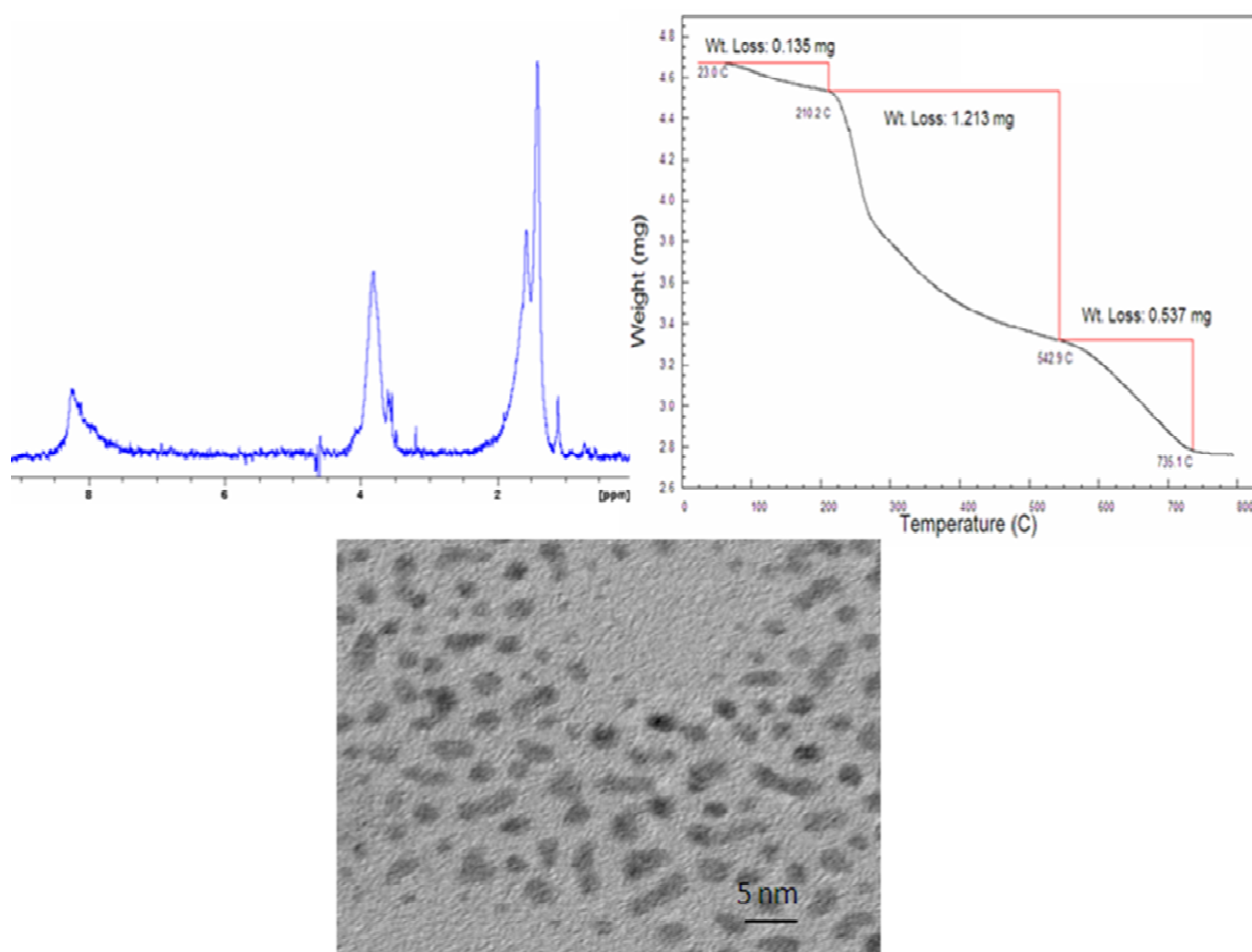


Figure S1. Original TMPC characterization data for PEG₄-acid. ¹H NMR shows characteristic line-broadening for TMPCs while TGA shows organic loss of 38% (first step is due to water loss and is subtracted from overall mass); TEM measurements showed an average particle size of 2.5 ± 0.6 nm.

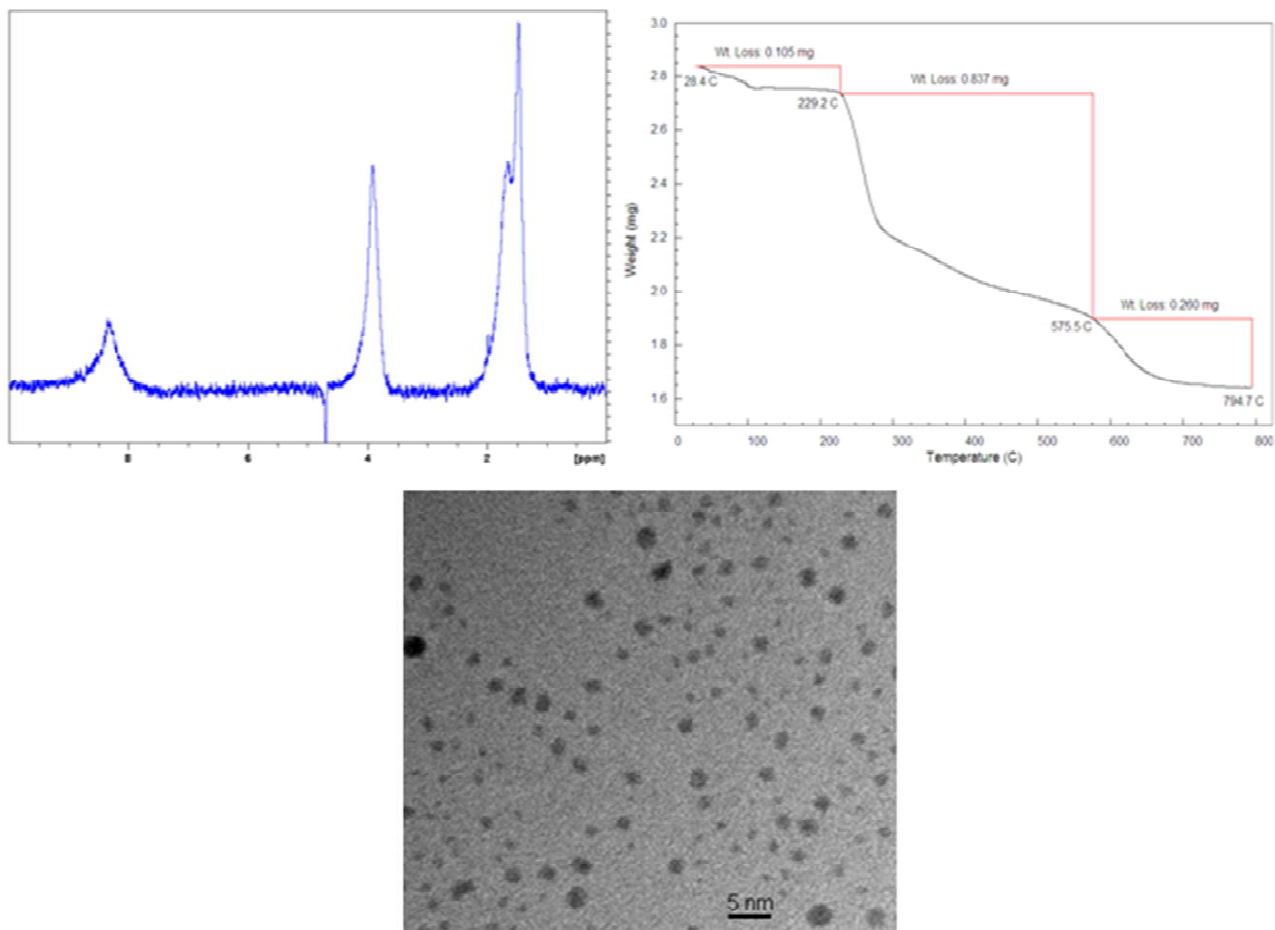


Figure S2. Original TMPC characterization data for PEG₄-OH. ^1H NMR shows characteristic line-broadening for TMPCs while TGA shows organic loss of 31% (first step is due to water loss and is subtracted from overall mass); TEM measurements showed an average particle size of 2.1 ± 0.5 nm.

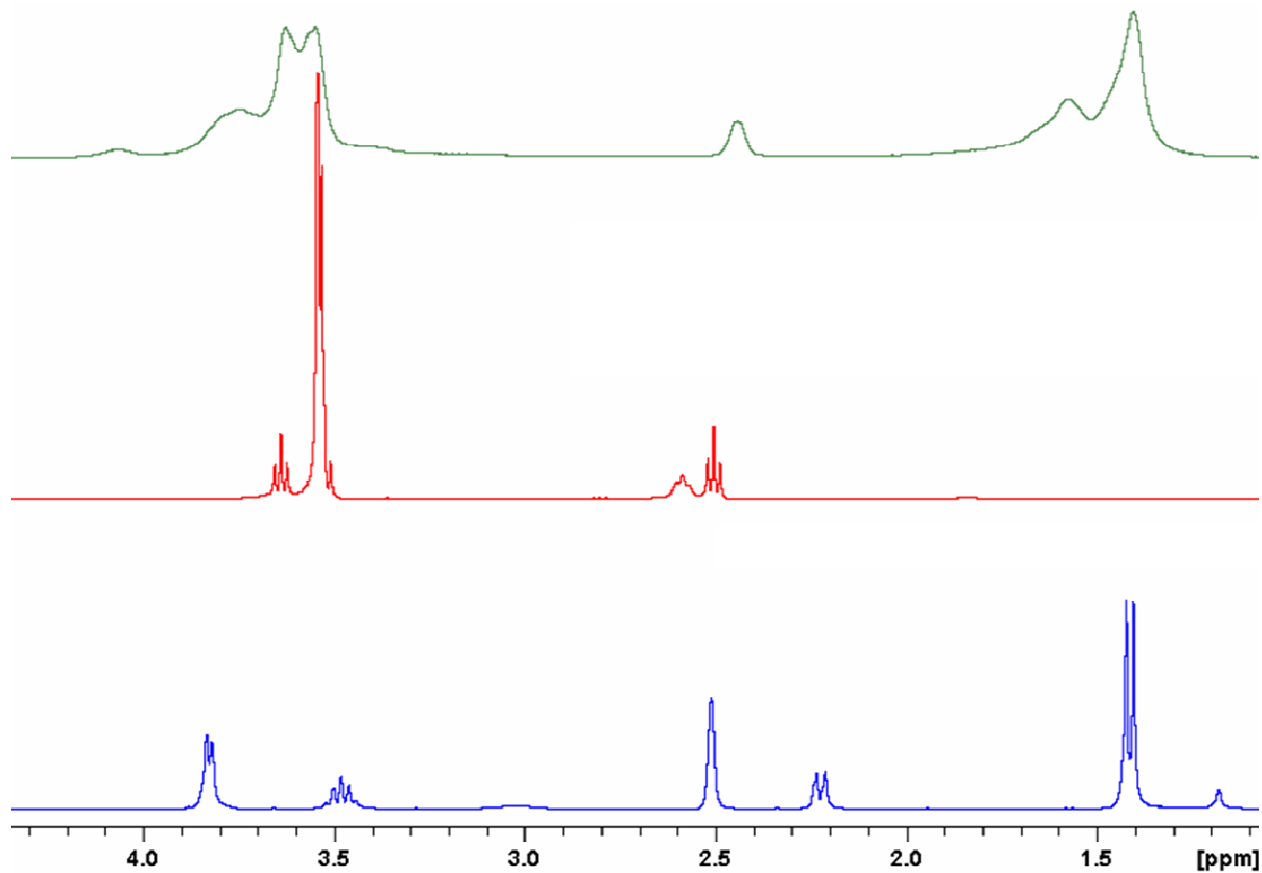
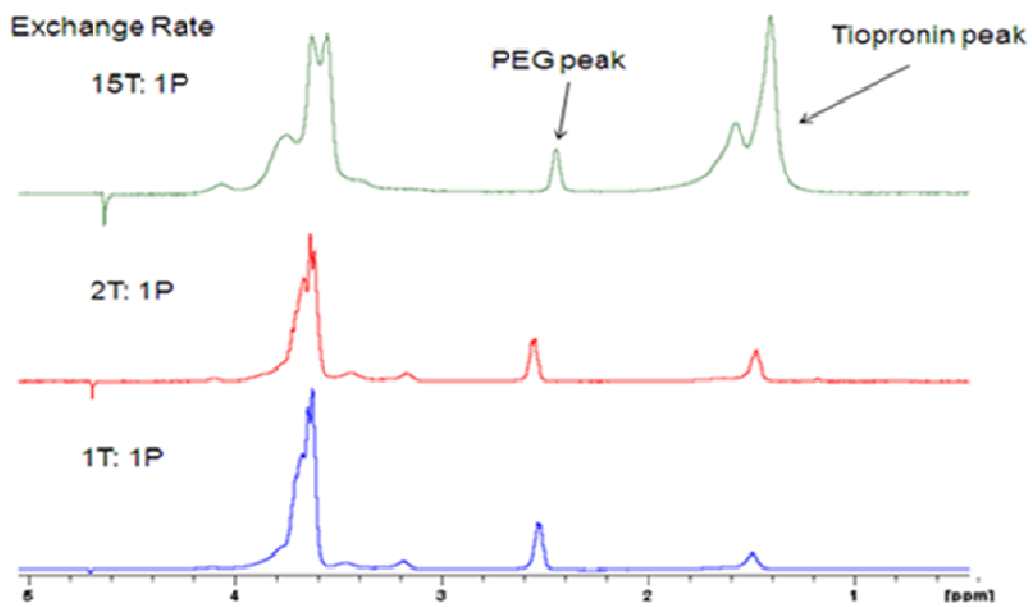
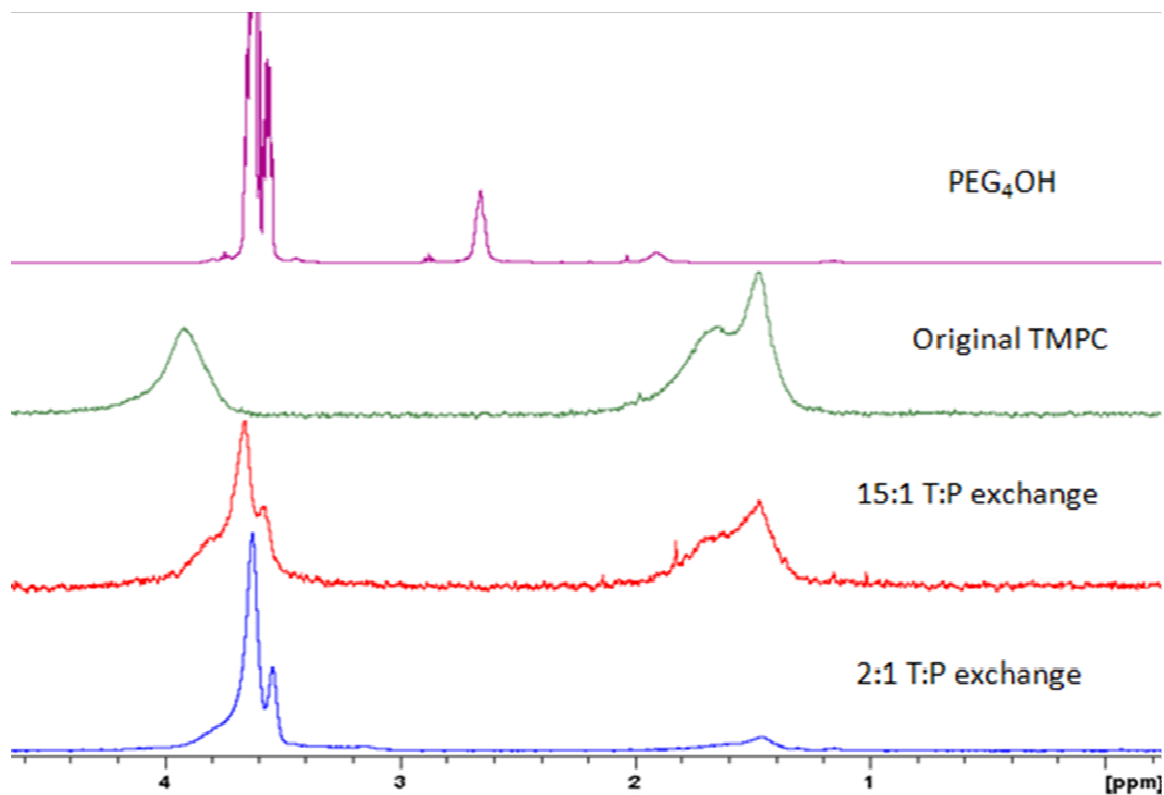


Figure S3. ^1H NMR spectra for tiopronin ligand (blue), PEG₄-acid ligand (red), and 15:1 exchange reaction (green). The peak at 1.4 ppm is isolated to the tiopronin ligand while the peak at 2.5 ppm is isolated to the PEG₄-acid ligand; these peaks were used for quantification in these studies as shown in the 15:1 exchange spectrum. The peak at 2.5 ppm in the tiopronin spectrum is due to the sulfur hydrogen, which is eliminated upon attachment to the gold core.



T:P exchange ratio (mol:mol)	NMR integration (T:P)	Molecular Formula by NMR	Percentage PEG by NMR
15:1	26:3	$\text{Au}_{485}\text{TiO}_{163}\text{PEG}_{19}$	~10%
2:1	2:3	$\text{Au}_{485}\text{TiO}_{73}\text{PEG}_{109}$	~60%
1:1	1:3	$\text{Au}_{485}\text{TiO}_{45}\text{PEG}_{137}$	~75%

Figure S4. ^1H NMR spectra for 15:1, 2:1, and 1:1 tiopronin: PEG₄-acid (mol:mol) place-exchange reactions and the resulting integration values, percentage PEG-ylation of the nanocluster, and improved molecular formula.



T:P exchange ratio (mol:mol)	NMR integration (T:P)	Molecular Formula by NMR	Percentage PEG by NMR
15:1	15:2	Au₂₈₇TiO₇₄PEG₁₀	~11%
2:1	2:3	Au₂₈₇TiO₃₄PEG₅₀	~60%

Figure S5. . ¹H NMR spectra for PEG₄-OH ligand (purple), original TMPC (green), 15:1 exchange reaction (red) and 2:1 exchange reaction (blue). The peak at 2.5 ppm in the PEG₄-OH spectrum is due to the sulfur hydrogen, which is eliminated upon attachment to the gold core. Also shown are the resulting integration values, percentage PEG-ylation of the nanocluster, and improved molecular formula.

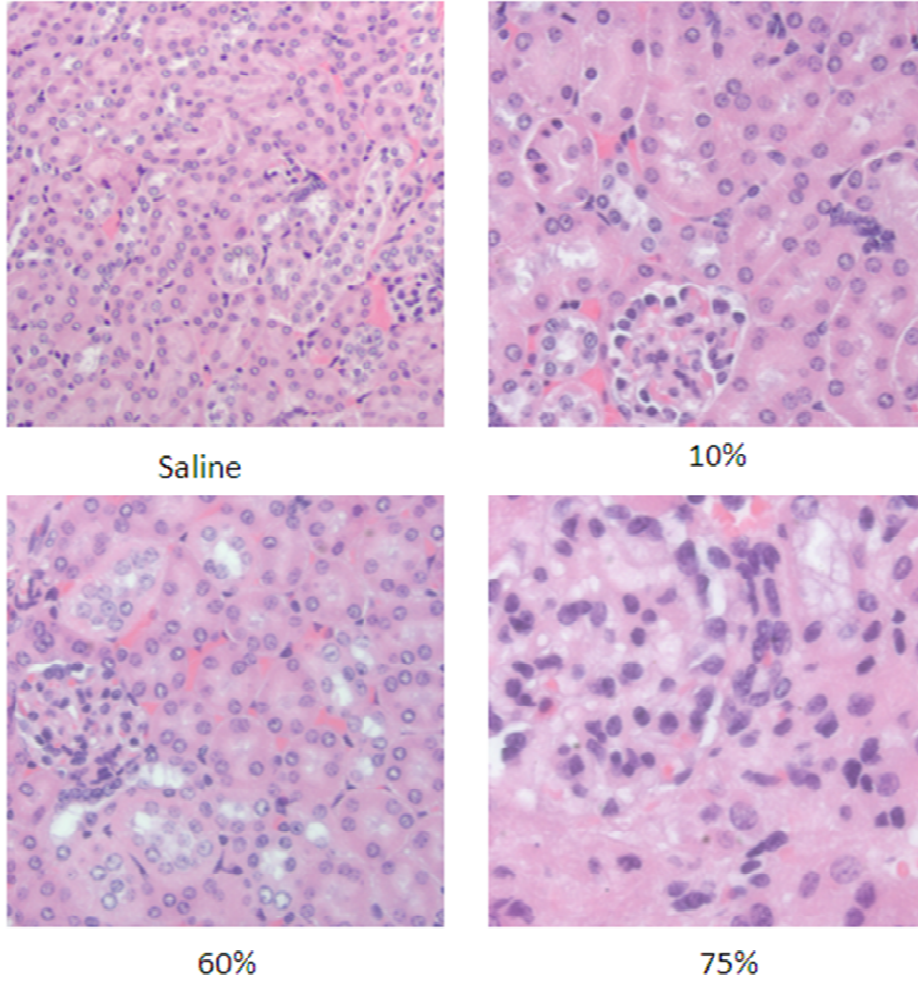


Figure S6. Renal histological analysis for representative saline subject and all PEG₄-acid place-exchange subjects. Mild increase in cellularity of glomerular tufts was noted for both control and injected subjects and was deemed minimal and attributable to a background lesion after subsequent PAS staining.

PEG ₄ -acid Average WBC counts (cells x 10 ³ /mL)			
Formulation	0 weeks	2 weeks	4 weeks
Saline	1.49 ± 0.51	1.34 ± 0.59	1.63 ± 0.13
10% PEG	1.63 ± 0.23	1.57 ± 0.38	1.20 ± 0.45
60% PEG	1.38 ± 0.28	1.30 ± 0.69	0.99 ± 0.09
75% PEG	1.84 ± 0.08	1.59 ± 0.93	1.21 ± 0.49

PEG ₄ -OH Average WBC counts (cells x 10 ³ /mL)			
Formulation	0 weeks	2 weeks	4 weeks
11% PEG	1.14 ± 0.30	1.20 ± 0.89	1.89 ± 0.84
60% PEG	1.43 ± 0.85	2.13 ± 0.55	2.36 ± 0.96

PEG ₄ -acid Average RBC counts (cells x 10 ⁵ /mL)			
Formulation	0 weeks	2 weeks	4 weeks
Saline	2.00 ± 0.77	1.43 ± 0.49	2.07 ± 0.15
10% PEG	2.04 ± 0.27	1.73 ± 0.12	1.56 ± 0.57
60% PEG	2.00 ± 0.35	1.66 ± 0.58	2.98 ± 0.15
75% PEG	2.17 ± 0.25	1.66 ± 0.84	2.78 ± 0.59

PEG ₄ -OH Average RBC counts (cells x 10 ⁵ /mL)			
Formulation	0 weeks	2 weeks	4 weeks
11% PEG	1.90 ± 0.07	2.84 ± 1.49	2.39 ± 0.80
60% PEG	1.43 ± 0.56	3.18 ± 0.65	2.61 ± 1.17

Figure S7. Individual WBC and RBC count at 0, 2, and 4 weeks for both short-chain PEGs investigated. A significant increase in individual RBC counts was noted for the PEG-acid chain at 4 weeks for both 60% and 75% coverage, independent of WBC count, and is shown in bold.