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Electronic Supplementary Information (ESI) for

Colorimetric detection of creatinine using its specific binding peptides and gold nanoparticles

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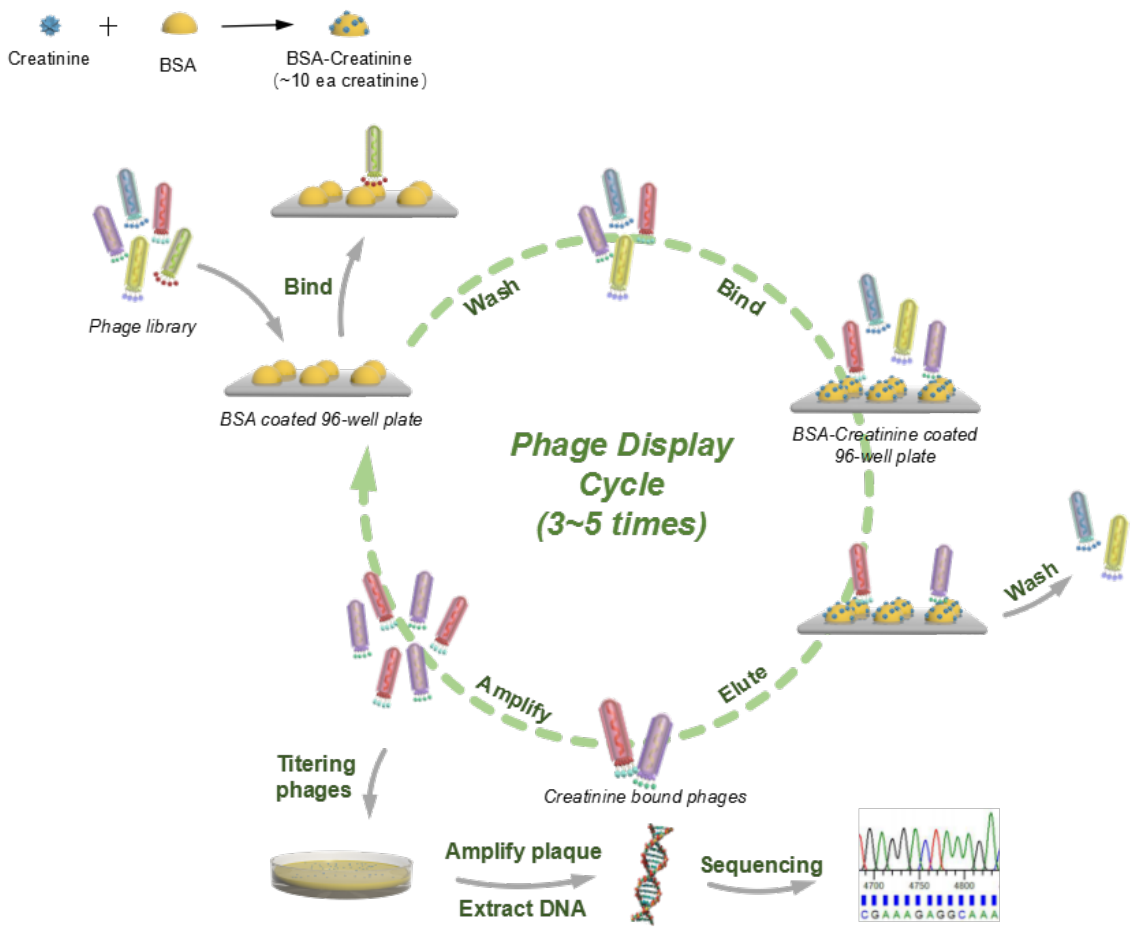

Scheme S1. Schematic diagram of BSA-Creatinine screening method by phage-display technology.

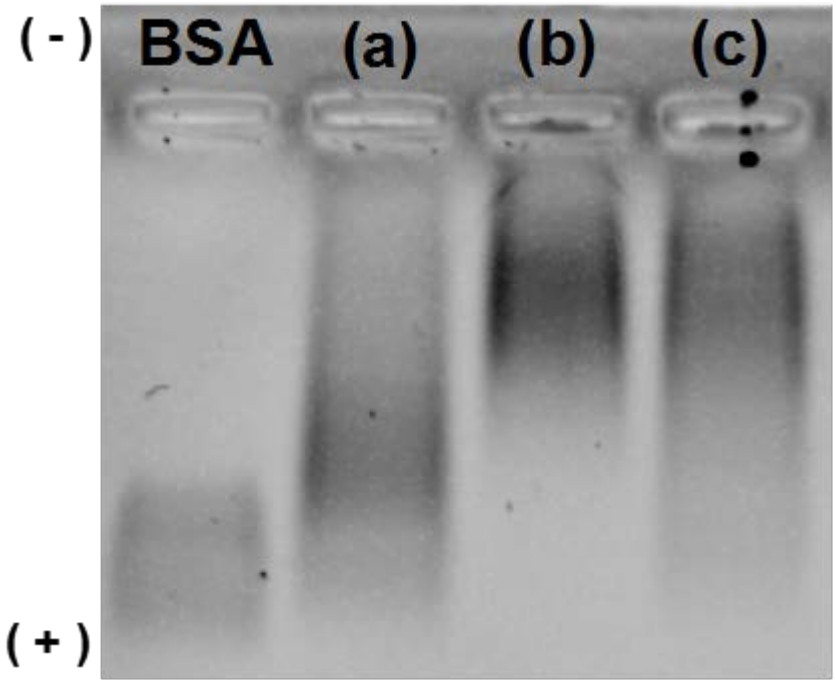

Fig. S1. The agarose gel image against BSA and BSA-creatinine with the concentration ratio of BSA and creatinine were (a) 4:1, (b) 2:1, and (c) 1:1.

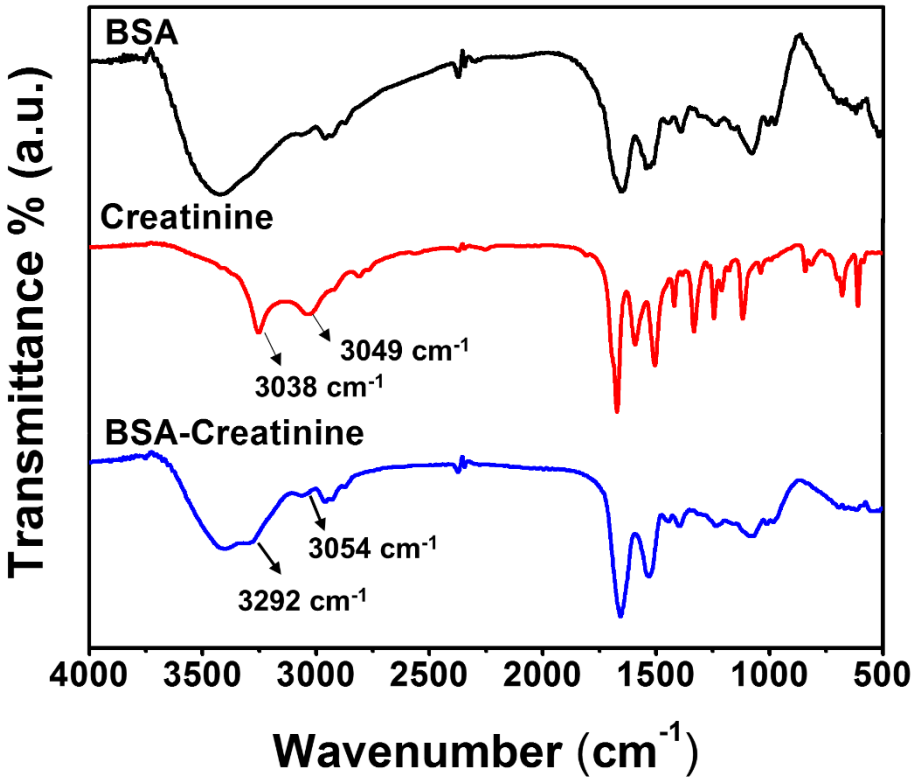

Fig. S2. FT-IR spectra of BSA, creatinine, and BSA-creatinine.

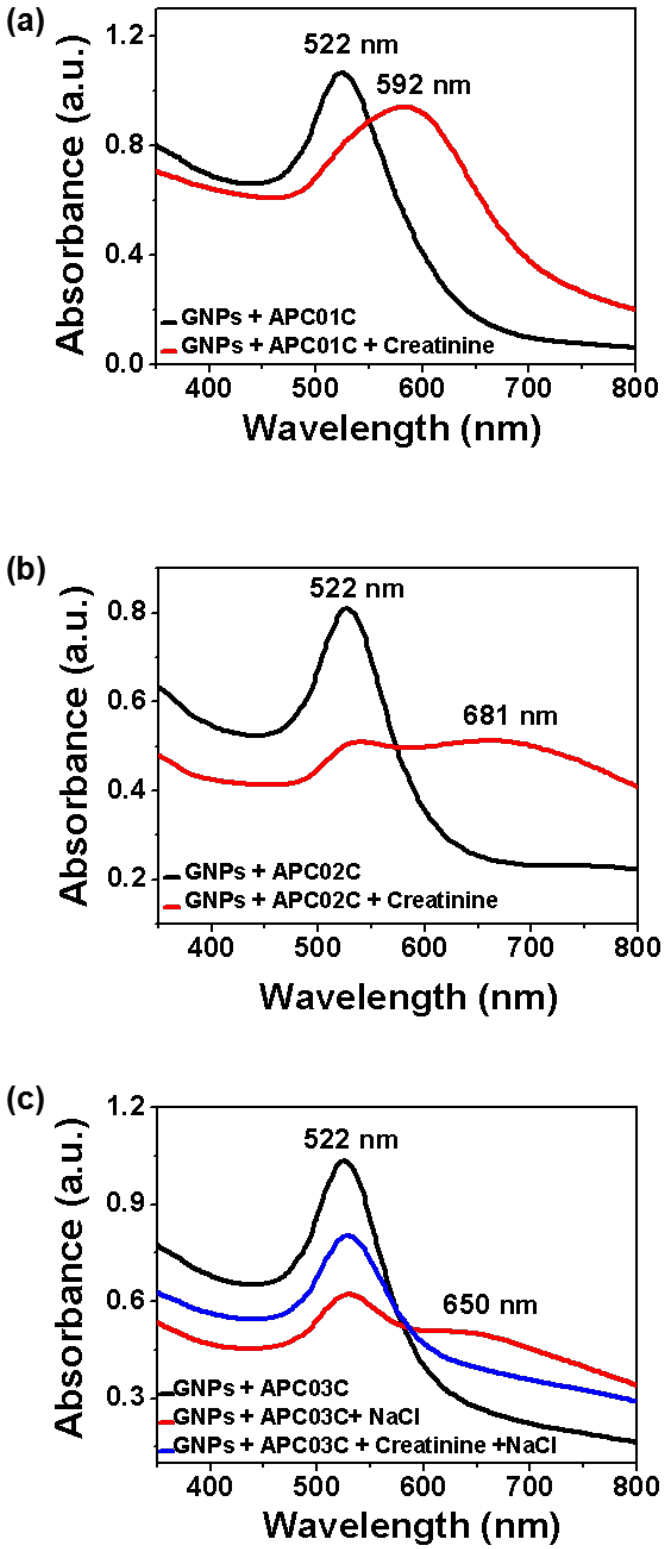

Fig. S3. Optical spectra of GNPs with different peptides, (a) APC01C, (b) APC02C, and (c) APC03C in the presence and the absence of creatinine.

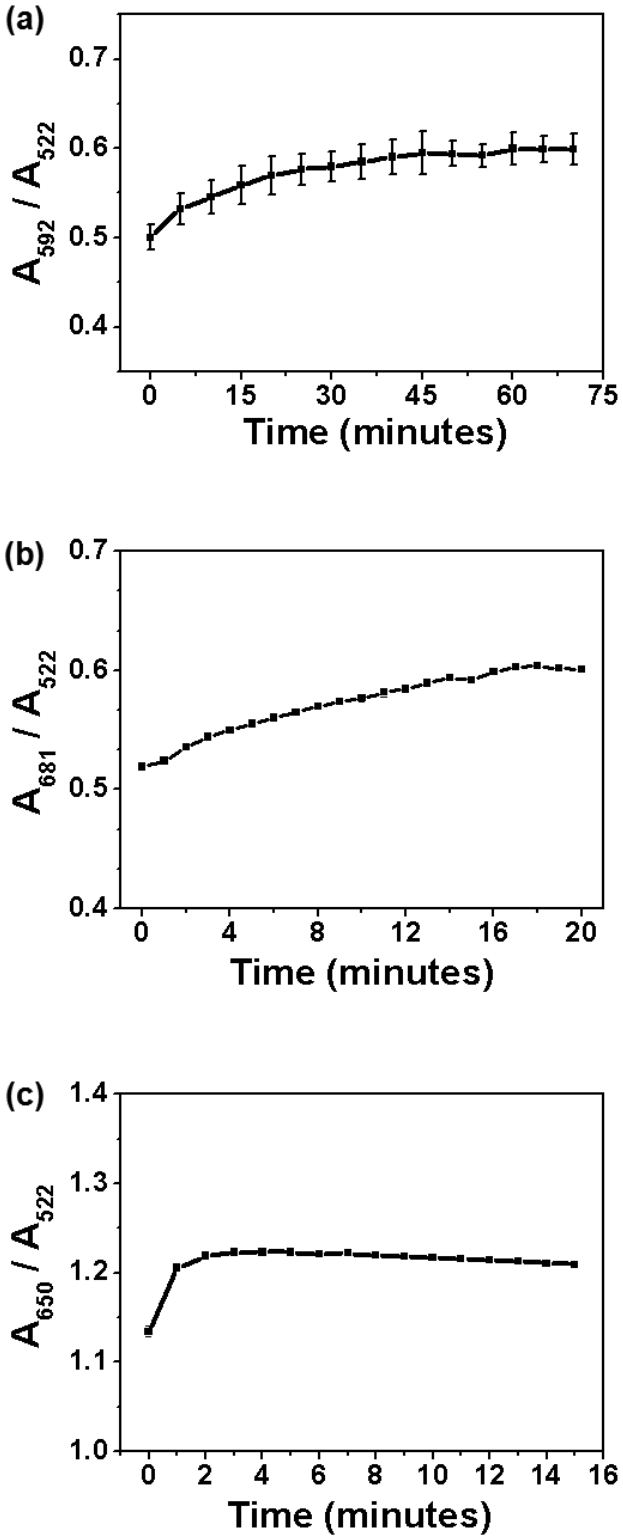

Fig. S4. Reaction time for the detection of creatinine using GNPs capped with different peptides, (a) APC01C, (b) APC02C, and (c) APC03C.

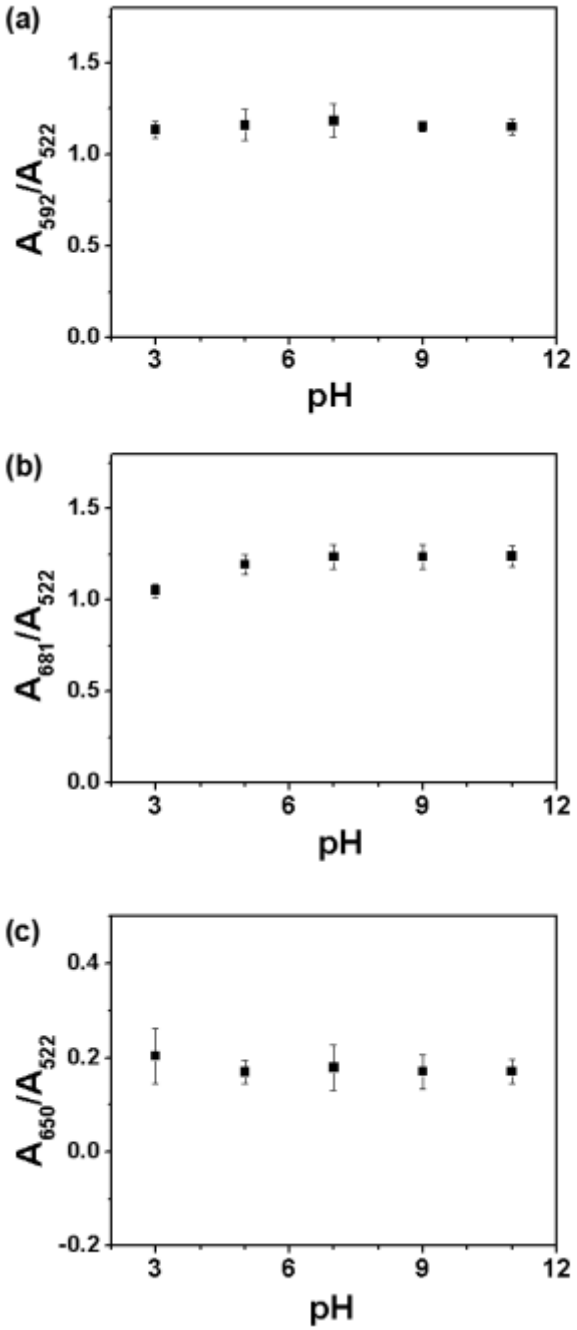

Fig. S5. Absorption change for the detection of creatinine using GNPs capped with different peptides, (a) APC01C, (b) APC02C, and (c) APC03C, in PBS solutions at different pH levels.

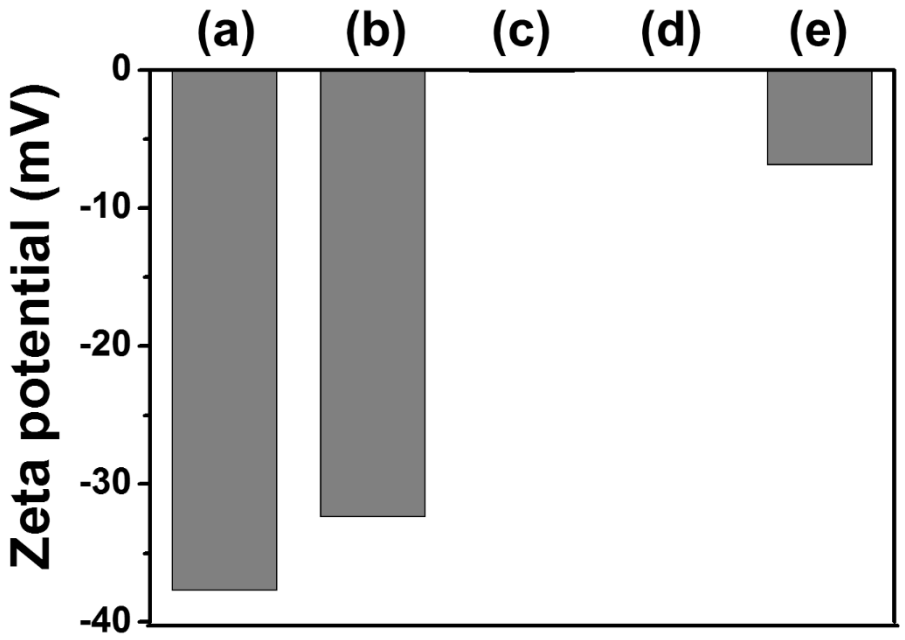

Fig. S6. Zeta potential of GNPs with APC03C in the presence and the absence of creatinine, (a) GNPs, (b) GNPs+APC03C, (c) GNPs+APC03C+NaCl, (d) GNPs+Creatinine+NaCl, and (e) GNPs+APC03C+Creatinine+NaCl.

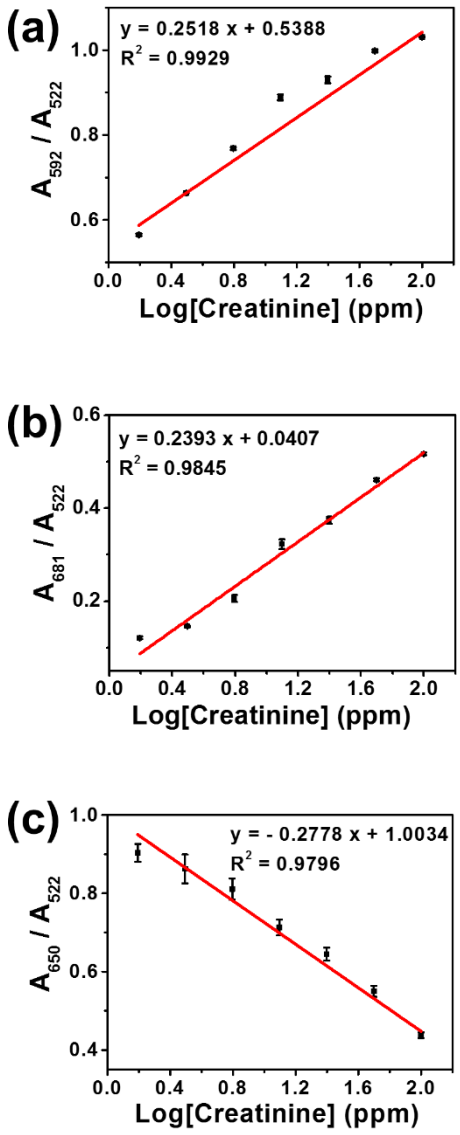

Fig. S7. Calibration graph in the range of 0-100 ppm for the detection of creatinine from spiked urine samples using GNPs with different peptides, (a) APC01C, (b) APC02C, and (c) APC03C.

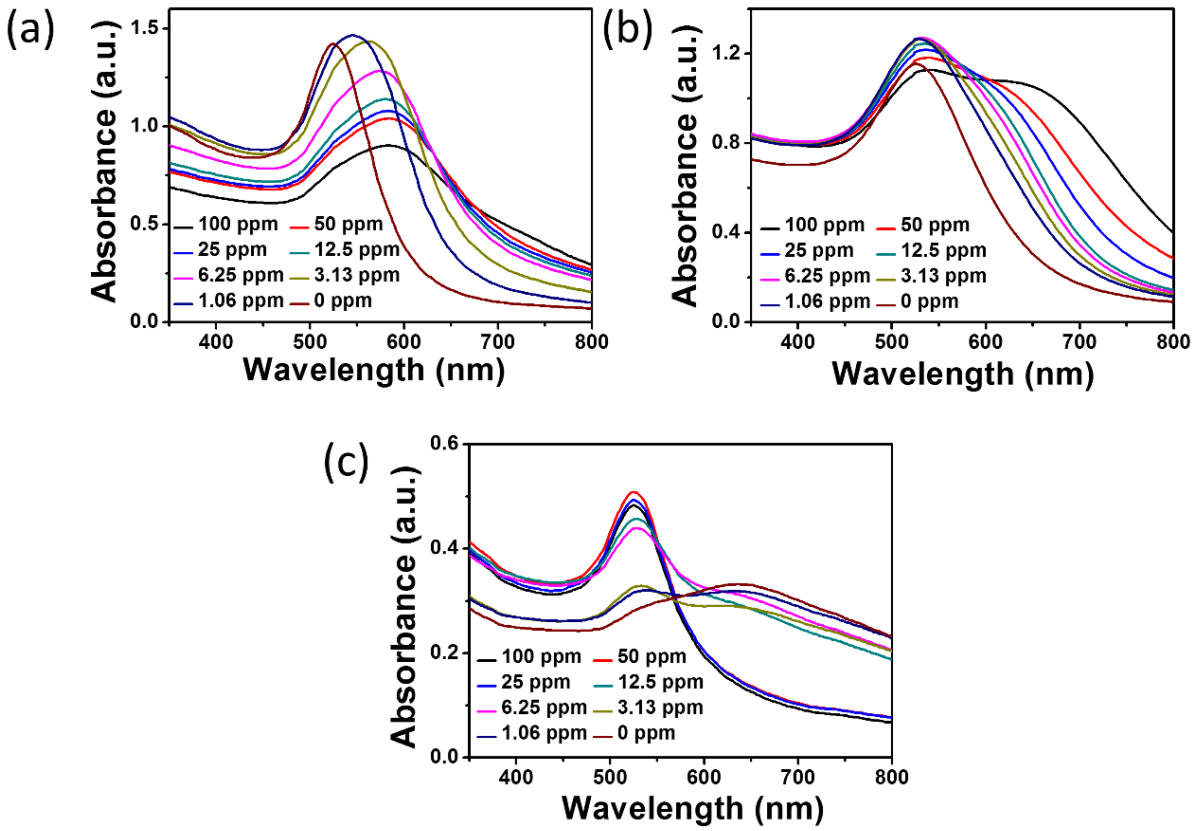

Fig. S8. The absorption spectra of GNPs for the detection of creatinine using GNPs with different peptides, (a) APC01C, (b) APC02C, and (c) APC03C, in the range of 0-100 ppm.

Table S1. The recovery table of phage-display biopanning

Sample	Round of panning	Input phage (PFU)	Output phage (PFU)	Phage recovery (output/input, %)
BSA-creatinine (12-mer kit)	1	1.0×10^{11}	5.9×10^{5}	5.9×10^{-6}
	2	1.0×10^{11}	1.1×10^{6}	1.1×10^{-5}
	3	1.0×10^{11}	3.4×10^{6}	3.4×10^{-5}

Table S2. The discovered peptide sequence from phages (The underlined sequences are candidate peptides)

BSA-creatinine (12-mer kit)	
WDMWPSMDWKAE (3 times)	ACP01C
VLVRDNLPTTTG	ACP02C
VQVRDNLPTTTG (5 times)	ACP03C
ISVVLCFALGII	
GPWYRFSTYEAN	
LGYVAVYGWKPE	
VDIKSHFSHTGK	
LVIPFGRYVSAL	

Table S3. Different sensors and parameters for creatinine detection

Sensor		LOD	Reaction time (min)	Sample	Reference
Ag Nanoparticles		0.46 mg/dL (4.520 ppm)	<5	Blood	1
Enzyme-amperometric sensor		0.06 mg/dL (0.989 ppm)	-	Serum	2
Photonic crystal sensor		6.0 μM (0.678 ppm)	30	Serum	3
Colorimetric Detection *via* plasmonic Nanoparticles		0.13 mM (15.25 ppm)	-	Urine	4
Colorimetric Detection *via* PEG/Hg^{2+}-AuNPs		0.451 μM (0.070 ppm)	-	Urine	5
Portable microfluidic sensor by Laiwattanapaisal		3.3 mg/L (3.300 ppm)	2	Urine	6
Specific binding peptide and gold nanoparticles	APC01C	0.025 ppm	40	Urine	***This study***
	APC02C	0.657 ppm	16		
	APC03C	0.346 ppm	2		

Additional references

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